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NEW BONE GROWTH DUE TO COLD WATER IN THE EARS

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Van Gilse [1] reported that exostoses in the external auditory canal are often found in cold water swimmers. In a discussion of his paper at the Collegium Otolaryngologicum, in Venice, in 1937, it was brought out by Italian otologists that exostoses are rarely seen in Italy. The inference is that Italian swimmers, who usually use the warm water of the Adriatic, are not subject to exostosis to the same extent as are the Dutch, who are wont to swim in the cold waters of the North Sea or in the Baltic.

Of 25 patients with hyperostosis and 9 with discrete exostoses of the external auditory canal observed in the last three years in the office practice and in the hearing clinics of one of us, (E. P. F.) [2] all but 4 had been ardent cold water swimmers. Two of the 4 exceptions swam on college swimming teams in heated pools. The other 2 (both of whom had hyperostoses rather than distinct exostoses) never swam, even as children, but had recurrent, low grade external otitis in the summer-

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* The experiments here reported were done in partial fulfilment of the requirements for completion of a residency in otolaryngology at St. Luke's Hospital, New York, in affiliation with the postgraduate basic science course at Columbia University. They were first reported by Dr. Osmun before the Section of Otolaryngology, New York Academy of Medicine, May 21, 1941.

1. van Gilse, P. H. G.: Des observations ultèrieures sur la génèse des exostoses du conduit externe par l'irritation d'eau froide, Acta oto-laryng. **26**: 343-352, 1938.

2. Conservation of Hearing Clinic of the New York League for the Hard of Hearing, at the Manhattan Eye, Ear and Throat Hospital, and the Special Deafness Clinic at the Vanderbilt Clinic of Presbyterian Hospital.

time. Six of the 30 cold water swimmers had, or had a history of, similar low grade external otitis. The chief complaint of most of the patients was blockage of the canal due to wax in the narrow opening. The cerumen was usually mixed with desquamated epithelium and was difficult to remove, suggesting antecedent external otitis.

Holmgren [3] drew attention to the fact that there is apparently a poor blood supply in the external canal and the drum of otosclerotic patients. He expressed the belief that this is evidenced by the tendency of such persons to have wide open canals, very poor in cerumen, and transparent drums, a condition which he interpreted as atrophy from poor blood supply. Continued cold, presumably would shrink the blood vessels of the external canal and reduce its blood supply. It is well known that a sluggish blood supply in potentially osteogenic tissue often precipitates new bone formation. It is folklore in Canada and northern New England that if the ears are not covered with muffs in the winter they will become deafened. However, to our knowledge, deafness from this cause has never been authenticated; in particular, there are no reports of more cases of otosclerosis, or, for that matter, of hyperostosis of the canal, in cold, windy climates.

With this vague background, it was decided to investigate the effect of cold water on the external auditory canals of animals. If van Gilse's theory is correct, it should be possible to produce exostoses of the external auditory canal experimentally. Guinea pigs were selected for these preliminary experiments because of their availability and general ease of handling. To our surprise, the changes produced by cold water in these animals were striking not in the external auditory meatus but in the middle ear.

METHOD

The guinea pigs were anesthetized with pentobarbital sodium, injected intraperitoneally. A solution with a strength of 60 mg. per cubic centimeter was used. An average of 0.4 cc. was given a 600 Gm. guinea pig to secure surgical anesthesia. Cold water at 19 C. (67.5 F.) was run slowly into the right ear through a small urethral catheter. Care was taken that the end of the catheter approached the drum membrane but did not damage it. Pressure was obtained from the cold water tap, the water running through a hose submerged in a bucket of ice and salt and flowing at a rate of approximately 30 cc. a minute. The great difficulty was to keep the animals alive through repeated anesthesias.

ANIMAL PROTOCOLS

GUINEA PIG 1.—*Two treatments, one hour each, one week apart. Death in the third week with circular movements to the right and muscular twitching. Weight 480 Gm.*

3. Holmgren, G.: Otosclerosis: Symptoms in the External and Middle Ear, Acta oto-laryng. **29**:91-98, 1941.

External Canal.—On the experimental, or right, side the canal showed moderate subcutaneous inflammation, especially near the drum membrane, with some hyaline degeneration of the connective tissue and moderate thickening of the epithelium. The wall of the bony canal presented some osteoclasis and a few bone spaces with two layers of very thin new bone. There was some question whether the new bone was pathologic, for similar bone, if not quite as extensive, was observed in the control ear.

Middle Ear.—On the right side the cavity contained a very small amount of inflammatory exudate. The subepithelial tissue was tremendously thickened and edematous (fig. 1). It contained a series of islands of very young, weblike,

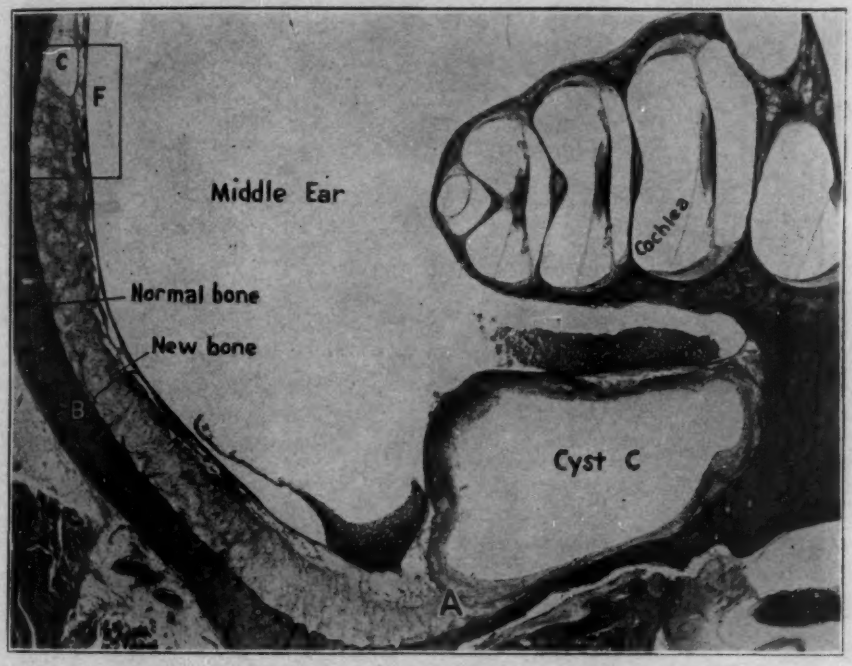

Fig. 1.—Horizontal section through the cochlea and middle ear of guinea pig 1, experimental side. Note the new bone growth (*A*), normal wall of the bulla (*B*) and cyst formation (*C*). *F* is the area shown in figure 2.

fibrillar bone, surrounded by osteoid tissue and interspersed with fibrous tissue containing many new blood vessels. In some areas were scattered round cells and what looked like rapidly growing fibroblasts, suggestive of a low grade inflammatory process. On the other hand, this picture did not in any way resemble that of ordinary otitis media. The new bone growth was much more extensive within the mucosa, and there was no evidence of concomitant bone destruction or of pus formation. The new bone was most conspicuous anteriorly, posteriorly and in the dependent parts of the bulla of the middle ear and was not present over the promontory. In the inferior portion of the middle ear

were engorged areas, some containing a few leukocytes, others a homogeneous pink-staining coagulum, while still others were empty (fig. 2). These last areas resembled blind pockets of edema rather than vessels. Although there

Fig. 2.—High power magnification of area *F* in figure 1. Note that the primitive bone growth in the mucosa (*A*) is even thicker than the normal bony wall of the bulla (*B*). Note also the small cyst (*C*), new bone trabeculae (*D*), edematous fibroblastic tissue (*E*) and osteoid tissue (*O*).

was inflammatory tissue in the niche of the round window, no new bone formation was present there or in the region of the stapes.

Internal Ear.—There was considerable blood, probably post mortem, in the internal auditory meatus. The blood vessels were congested here and in the aquaeductus cochleae, but no polymorphonuclear neutrophils were seen. Here and there were a few lymphocytes and monocytes.

Control Ear.—On the left, or control, side the middle ear and the external canal were normal (fig. 3). However, a pink-staining coagulum, containing a few red blood cells and lymphocytes, filled the endolymphatic cavity; this may account for the labyrinthine symptoms observed just before the animal's death.

GUINEA PIG 2.—*Death from anesthesia one week after initial, and only, irrigation.*

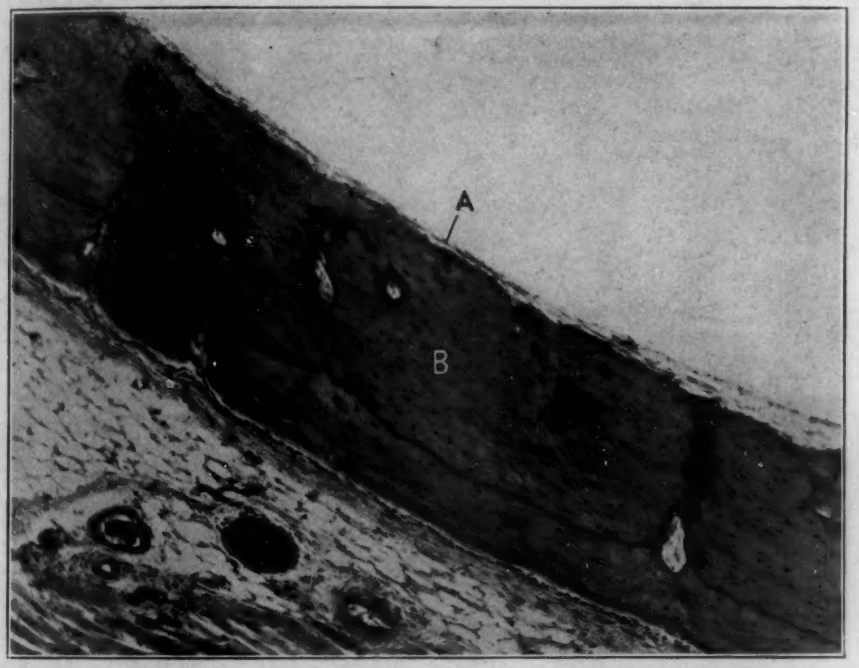

Fig. 3.—Control ear of guinea pig 1, showing thickness of the mucosa (*A*) and of the normal wall of the bulla (*B*). Compare with structures shown in figure 2.

The temporal bones showed little change. There was no edema and only somewhat questionable evidence of beginning bone formation, such as was observed in guinea pigs 1, 3, 4 and 5. There were perhaps more fibroblasts in the submucosa of the middle ear on the experimental than on the control side, and these were surrounded by hyaline material, but whether the process would go on to bone formation was uncertain.

GUINEA PIG 3.—*Six weekly irrigations of one hour each at 19 C.*

The middle ear showed thickening of the subepithelial layer, with fibrotic tissue and islands of new bone formation. Large wandering cells were predomi-

nant, with very few polymorphonuclear neutrophils. The picture was that of a productive process, with formation of new bone on the promontory and along the walls of the dependent portions of the middle ear. Incidentally, this animal had six irrigations, yet the process was less extensive than in guinea pig 1, which received only two irrigations (fig. 2 and 4). Unfortunately, the left, or control, ear was destroyed in preparation.

GUINEA PIG 4.—*Six weekly treatments, totaling six and one-half hours; temperature 19 C. Weight 600 Gm.*

External Canal.—In the right, or experimental, ear a layer of new bone had formed, more noticeable on the posterior than on the anterior wall. This occurred

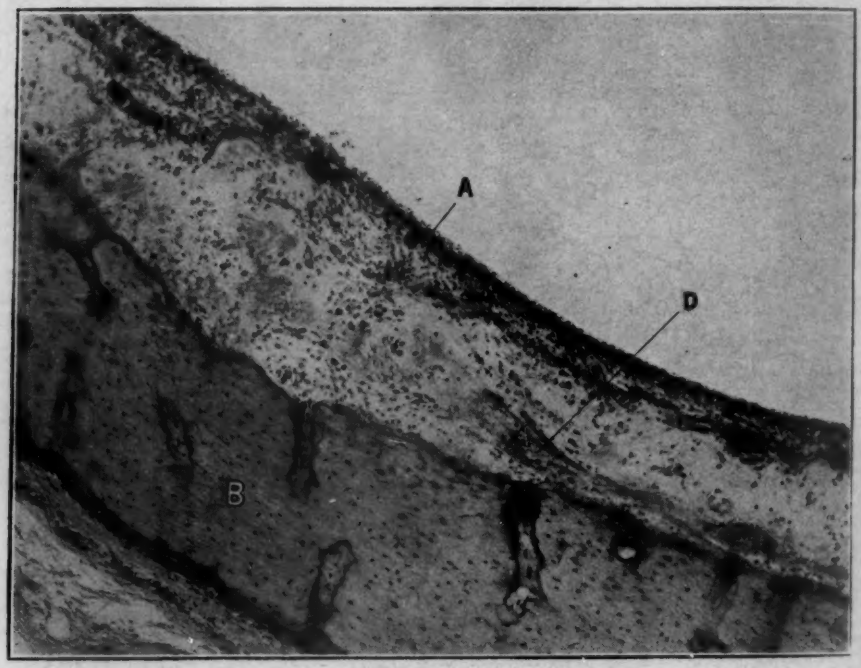

Fig. 4.—Primitive bone growth in the mucosa (*A*) of the middle ear of guinea pig 3, experimental side. The normal capsule is indicated by *B* and new bone trabeculae by *D*.

also in the control ear. In the latter, however, no new bone was observed close to the drum membrane.

Middle Ear.—On the experimental side a mastoid air cell just posterior and inferior to the incus showed new bone formation. Elsewhere new bone growth in the middle ear was much less conspicuous than in experimental animals 1 and 5, and low grade irritation was less evident. There was no new bone in the niche of the oval window, but a few areas of irregular new bone formation on the promontory appeared (fig. 5). The mucous membrane lining was much

less swollen in this guinea pig than in guinea pigs 1, 3 and 5. Anteriorly, however, there was evidence of beginning cyst formation, with a very thin layer of new bone beneath.

GUINEA PIG 5.—*Nine weekly treatments, totaling eleven and a half hours, at 19 C. Weight 600 Gm.*

External Canal.—Pronounced thickening of the subcutaneous tissue, with considerable engorgement of the blood vessels and some extravasation of blood into the tissue, was present. In some areas fingers of stratified squamous epithelium ran down into the subcutaneous tissue. In the anterior wall of the canal was a large mass of partially hyalinized connective tissue, in the middle

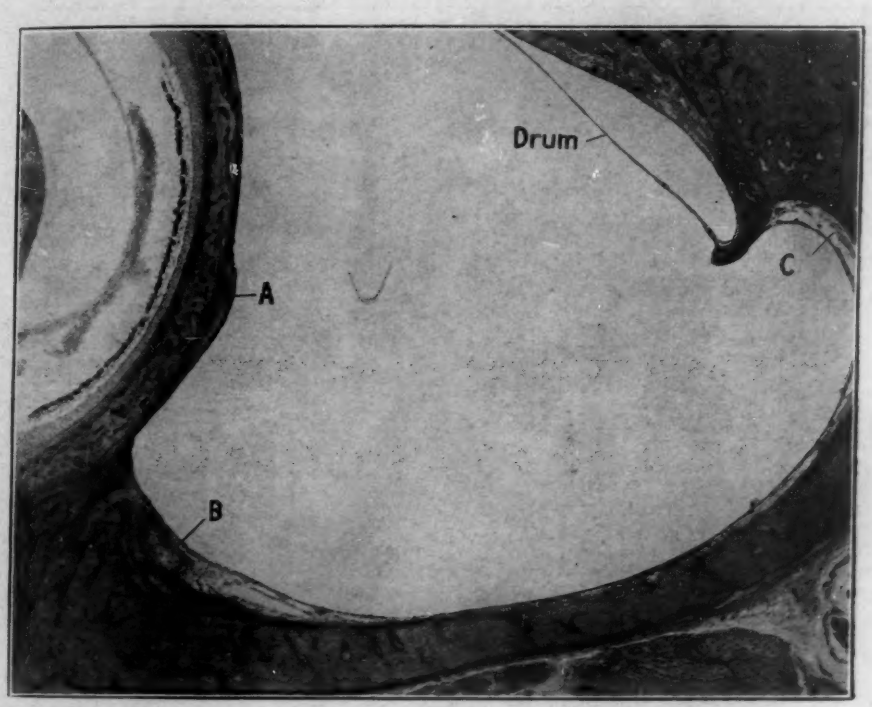

Fig. 5.—New bone growth on the promontory (*A*) and in the niche between the promontory and the beginning of the bulla (*B*) of the middle ear of guinea pig 4, experimental side. The cystic area in the submucosa, near the drum membrane, is indicated by *C*. Low power magnification.

of which occurred a few small islands of cells resembling osteoblasts (fig. 6). The arterioles here were much thickened and the veins engorged with blood.

The wall of the bony canal of the left, or control, ear showed several superficial layers of similar growth of new bone, but in no slide could one find three or four layers, as in the right ear.

Middle Ear.—The picture was exactly what one would expect if the process observed in guinea pig 1 had continued. The mucosal spaces, occupied in

guinea pig 1 by osteoid tissue and primitive bone trabeculae, were here filled with more adult bone, and the cystlike areas were completely encrusted with new but fully developed weblike bone with short fibrils (figs. 2, 7 and 8). In one place, a cyst encrusted with bone touched the promontory (fig. 7). The mucoperiosteum within the bone formation was heavily engorged with blood and contained a considerable number of leukocytes and fibroblasts, the picture suggesting infection in a more acute and advanced stage than that in guinea pig 1. New bone was formed in the niche of the oval window, but this occurred in the swollen submucosa, in the trabeculae between infected, epithelium-lined pouches,

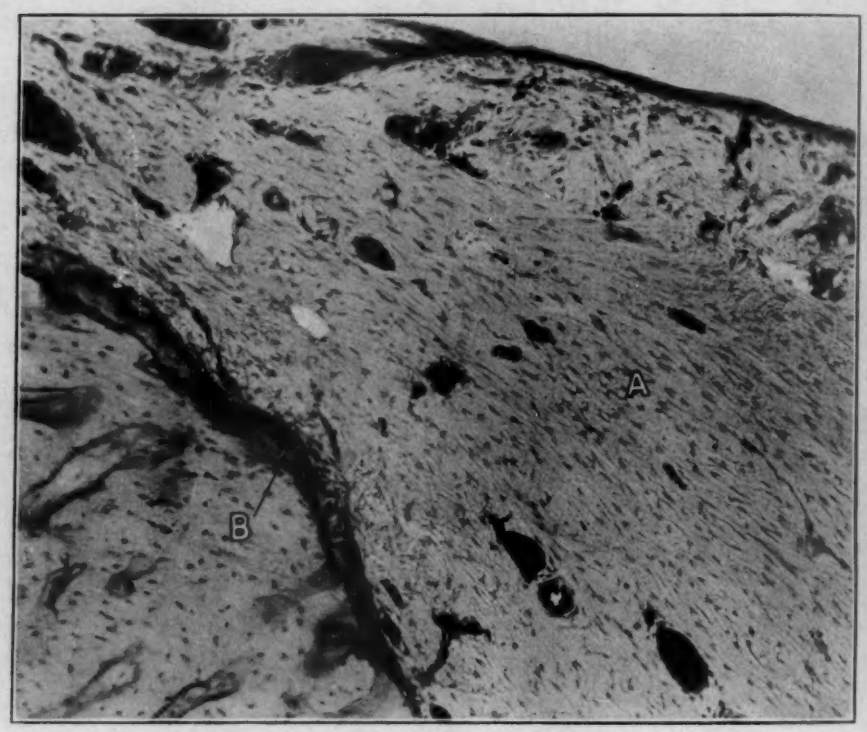

Fig. 6.—Horizontal section of the wall of the external auditory canal of guinea pig 5, showing edematous subepithelial tissue and increased fibroblasts with moderate hyalinization (*A*). A small amount of new bone is shown at *B*, which was not as striking on the other, or control, side.

and involved only superficially the labyrinthine capsule, the foot plate and the crurae of the stapes.

Control Ear.—The left temporal bone was normal (fig. 9).

COMMENT

Further work will have to be done, using such agents as water and physiologic solution of sodium chloride at body temperature, cold saline

solution and cold air, before the many questions suggested by this preliminary report can be settled. Similar experiments should be made on other bones of the body, especially those of the face. The present report is made because the experiments on guinea pigs have shown that cold water in the external meatus produces growth of new bone in the middle ear. These observations make it worth while to carry on further investigations to determine whether the changes are due to vasoconstriction from cold, low grade irritation set up by the hypotonic solution, maceration of the skin, secondary external otitis or some other factor. It would

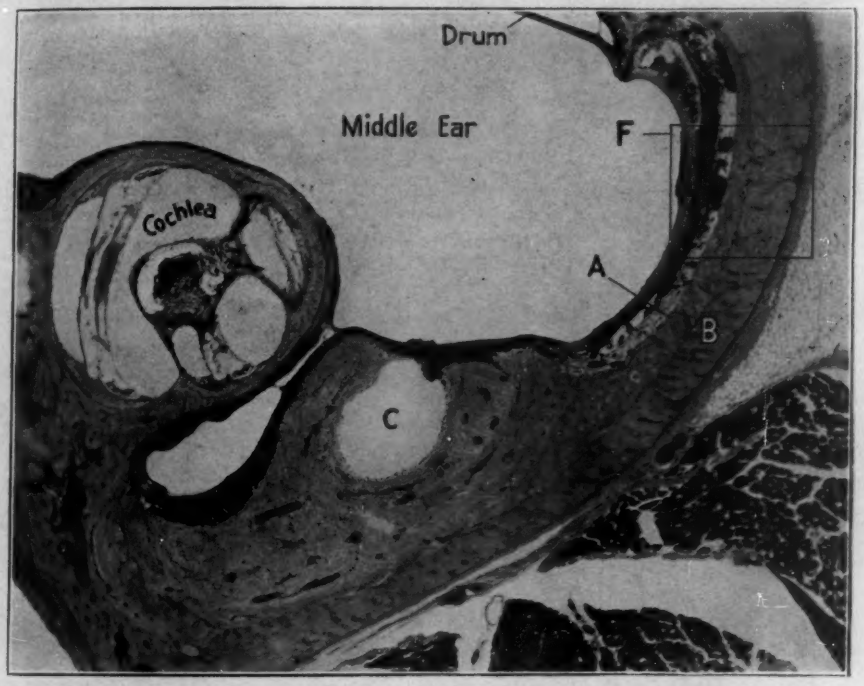

Fig. 7.—Section of the middle ear of guinea pig 5, experimental side. The new bone of the submucosa is indicated by *A*, the normal bony wall of the bulla by *B* and the cavity of the bony cyst by *C*.

also be interesting to find out whether with other animals or more extensive irrigation it would be possible to obtain more definite changes in the external canal.

SUMMARY

Guinea pigs were subjected to monaural irrigation of the external auditory meatus with cold water. In 4 out of 4 animals in which more than one irrigation was made, there was diffuse production of new bone in the submucosa of the bulla of the middle ear on the experimental side.

The new bone formation was more or less proportional to the number of times the cold water was used as a stimulus and to the total elapsed time.

Fig. 8.—Higher power magnification of area *F*, figure 7. Note congestion in the submucosa (*A*) and the new bone *A*.[1] Compare this more adult bone growth with similar areas in figure 2. The normal bony wall of the bulla is indicated by *B*.

There were no changes in the labyrinthine capsule except for slight growth of new bone on the most exposed portion of the promontory. These changes involved only the periosteal bone.

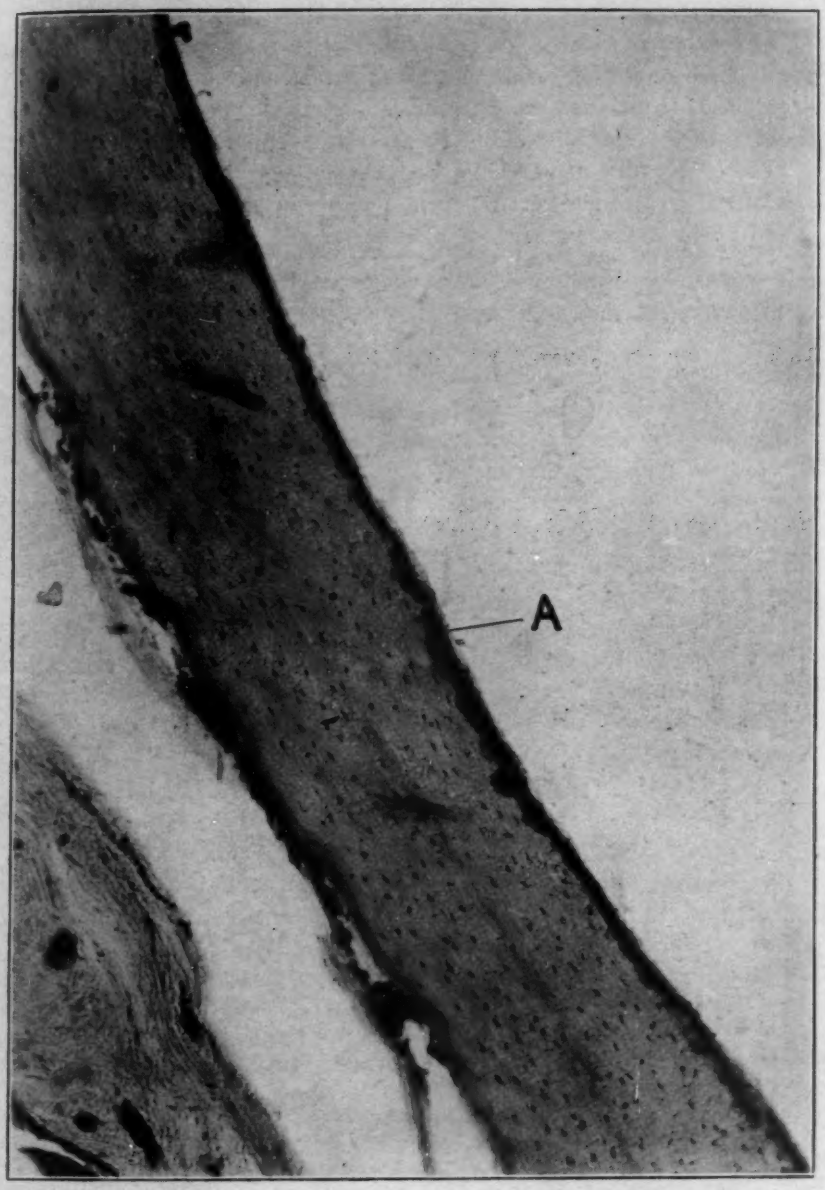

Fig. 9.—Control ear of guinea pig 5. The normal mucous membrane is indicated by *A*. Compare with figure 7.

In no case was there any clinical evidence of otitis media.

In no case was there sufficient microscopic evidence to explain the formation of new bone on the basis of infection.

The external canal of the experimental ears showed slight fibrosis and hyalinization of the soft tissue and occasionally a small amount of new bone. In no case was this alteration sufficiently striking, as compared with the control side, to be of certain experimental origin.

The observation of van Gilse that a history of cold water swimming can often be obtained from patients with discrete exostoses or with hyperostosis of the external canal is confirmed.

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LUDWIG'S ANGINA

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The clinical condition to be considered here was frequently cited briefly in descriptions of cases by ancient Greek physicians. Hippocrates, the great master physician of the fourth century B. C., made many references to this condition. Aretaeus, a distinguished contemporary of Galen, living in the second and third centuries A. D., Galen, Paulus of Aegina, Wells (1809) and Gregory (1822) also have referred to this condition. However, in 1836 and 1837 many articles began to appear in medical literature the subject of which was a brawny infection of the cellular tissues of the neck. Various names were given to the disease, such as "cynanche cellularis maligna" and "morbus strangulatorius." The leader of the group of physicians reporting on this and the author of the first article was Wilhelm Friedrich Von Ludwig, of Stuttgart, personal physician to the King of Württemberg. His description of the disease in 1836 as a "gangrenous induration of the neck" was so complete that it has left little but emphasis to be added by succeeding writers. A year later Camerer described a case and gave this condition the name by which it has come down to the present, Ludwig's angina. Since this time there have been several notable contributions to the subject, particularly by Parker (1819), Newcombe (1898), Hamann (1899), Thomas (1908), Muskleston (1928),[1] Blassingame (1928) [2] and Van Wagenen and Costello (1928).[3]

Few articles on Ludwig's angina are to be found in recent medical literature, and scarcely any two articles are in entire agreement as to the surgical procedure to be applied. The condition is therefore of sufficient rarity and interest to warrant a discussion.

The pathologic study reveals the characteristics of a rapidly spreading cellulitis beginning in the region of the submaxillary gland and extending to the floor of the mouth.

Read at the Sixty-Fourth Annual Meeting of the American Laryngological Association, Atlantic City, N. J., May 25, 1942.

From the Department of Otorhinolaryngology, Indiana University School of Medicine.

1. Muskleston, H. S.: Ludwig's Angina and Kindred Affections: Historical and Clinical Study, Ann. Otol., Rhin. & Laryng. **37**:711-735 (June) 1928.

2. Blassingame, C. D.: Anatomical and Clinical Study of Ludwig's Angina, Tr. Am. Laryng., Rhin. & Otol. Soc. **34**:33-53, 1928.

3. Van Wagenen, W. P., and Costello, C. V.: Sublingual Phlegmon: Primary and Secondary Ludwig's Angina, Ann. Surg. **87**:684-703 (May) 1928.

Van Wagenen and Costello [8] have offered the distinction in the types of Ludwig's angina and described a primary and a secondary type. The primary type is a typical cellulitis which begins as a perilymphadenitis and is considered the classic type of Ludwig's angina. They proposed a secondary type, in which the sublingual phlegmon is secondary to an infection of the lymph glands and a cervical abscess rather than an infection of the cellular tissue about the lymph glands or submaxillary salivary gland.

This discussion has to do with the primary type.

Newcombe, commenting on true Ludwig's angina, said: "The true way to look on the disease is to regard it, first, as an intensely infectious phlegmon and, second, as occurring under peculiar anatomic conditions."

Age incidence varies greatly, the disease occurring in patients from infancy to old age. However, the majority of patients are between 20 and 50 years (the age of dental caries).

Summary of all available data shows that males predominate more than 3 to 1. Males, being exposed more often to changes in atmosphere, are more frequently the subjects of anginas. Among the poorer classes the males give less attention to their teeth and are therefore more frequent sufferers from dental caries than are females.

Previous health apparently has no constant bearing on the development of the disease. The vast majority of the patients who have been treated at the Indiana University Hospitals had previously enjoyed good health, while only a few had suffered general ailments.

Dental infection, with or without trauma from extraction of diseased teeth, is one of the most frequent causes of Ludwig's angina. Dental caries may cause gangrene of the dental pulp, the infection spreading from there to the apex of the tooth and then to the alveolus, thereby causing fungosities with absorption of the cement of the tooth and of the corresponding wall of the alveolus. The pus discharges first by way of the canal inside the tooth, but if the canal is obstructed or is insufficient in size, a phlegmon develops. Usually pus pierces the alveolus in its thinnest part on the outer side of the mandible and forms a dentoalveolar abscess in the surrounding cellular tissue. The pus seldom works its way between the alveolus and the neck of the tooth, because the latter is united to the gingival mucosa by resistant fascia; thus it points toward the skin or toward places in the buccal mucosa more or less distant from the diseased tooth. In cases in which the process is acute there is no time for absorption of the alveolus; so the infection enters the dental cavity of the mandible, spreads and makes its way toward the cellular tissue, which separates the upper mylohyoid surface from the gum, or toward that which surrounds the carotid vessels in the neck. The strangulation resulting from the inflammation

of the dental canal may cause osteomyelitis of the mandible. It has been found that if a back or molar tooth is infected in this way the outer wall of the mandible is so thick that perforation occurs only on the inner wall, so that the sublingual tissue is infected at once.

Traumatic injuries of the interior of the mouth have been given as one of the frequent direct causes. Particular injuries are gunshot wounds of the check or mouth, wounds of the mucosa of the floor of the mouth and compound fractures of the lower jaw. Several other conditions have been found to be the origin of the infection. They are tonsillitis, peritonsillitis, Vincent's angina, facial erysipelas, otitis media and otitis externa, ulcers of the lip and nose, scarlatina and diphtheritic infections.

Bacteriologic studies show that the disease does not follow the line of a single infection. Streptococci are invariably found, but associated with them are staphylococci, Vincent's spirilla and fusiform bacilli, colon bacilli and in some cases gas-producing organisms.

Experimentation on animals by Blassingame,[2] in 1928, has indicated the courses which infections about the mouth may be expected to pursue. Infections arising around the inner side of the lower teeth and gums, except at the front, course down into the tissues of the sublingual pouch, where an inflammation begins which finally becomes a sublingual phlegmon, or Ludwig's angina. Not all infections pursue this simple course. Some of them pass on posteriorly without producing any sublingual inflammation and subsequently enter the general circulation and produce a general septicemia. Blassingame [2] stated that it is doubtful whether infections of the tonsil or any structure behind the styloglossus ligament are ever the primary source of Ludwig's angina.

The symptoms typical of Ludwig's angina are usually preceded by the symptoms of some intrabuccal infection which has gravitated into the floor of the mouth and into the neck. The swelling becomes progressively greater, and it may involve one or both sides of the neck. After the condition has become fully developed, it presents, according to Molt [4] and Newcombe, the following diagnostic points, which are thought to be sound: (1) a wooden-like induration of the affected region, sharply defined from the surrounding normal tissue; (2) the thrusting forward and upward of the tongue toward the palatal vault, due to the accumulating inflammatory products in the floor of the mouth; (3) severe dyspnea with the attendant danger of laryngeal edema (this is a fairly late manifestation of the disease and naturally varies with the rapidity with which the infection spreads), and (4) the presence of a hard pad or button-like swelling at the internal aspect of the dental arcade.

4. Molt, W. F.: J. Indiana M. A. **15**:196-200 (June) 1932.

General pain, redness, heat and swelling of the cervical region appear with the aforementioned signs, presenting the classic symptoms of a phlegmon. Swallowing is painful, if not impossible. Usually the mouth can hardly be opened, as the muscles performing this function partly are embedded in the infiltrated cellular tissue and partly participate in the inflammation. This is especially true of the mylohyoid muscle, which, being the floor of the mouth, is raised in deglutition.

With these local symptoms occur the systemic symptoms of a severe septicemia, which usually develop early in the disease. The systemic reaction to the disease depends on the stage to which it has progressed. In the later stages, when secondary complications have set in, the symptoms depend on the nature of these complications. Edema of the glottis and epiglottis are frequently encountered.

The temperature is septic and varies from 99 to 105 F. The blood picture shows a leukocytosis, with 10,000 to 20,000 leukocytes and even more in the later stages. The differential cell count shows a predominance of polymorphonuclear cells, usually 85 to 90 per cent, in the later stages. After the systemic symptoms have become pronounced, blood cultures show streptococci or staphylococci or sometimes a mixed blood stream infection.

Once the disease has reached its florid stage the treatment is supporting and surgical. All leading authorities agree that early radical surgical intervention cannot be too strongly urged. The fundamental principal of the operative procedure for this condition is primarily to relieve the tension or perform a "decompression" and secondarily to relieve pus. To relieve the tension it is imperative that the incision be a large one. When the sublingual tissues have become tense and indurated, an incision should be made to divide the mylohyoid and possibly the geniohyoid muscles on the affected side, or on both sides. The incision should begin below the mandible and a little lateral to the submaxillary gland, keeping close and parallel to the ramus of the mandible as the incision is carried forward through the deep fascia to the depth of the submaxillary gland and to the midline of the neck. No structures of importance are encountered except the facial artery. This vessel should be secured and ligated, as it may be stretched outward by the underlying swelling; if it is divided before being secured, it may retract into the edematous tissue, giving troublesome bleeding. Once the deep fascia is reached the use of sharp dissection is dangerous, and the deeper exploration is to be carried out with blunt dissection, or with forceps after Hilton's method up to within a short distance of the floor of the mouth. Some authorities recommend carrying the incision through the floor of the mouth, but this, I think, is unnecessary, increasing opportunity for infection of the neck and creating the possibility of swallowing or aspirating infectious material.

When the principal part of the cervical infection is submental or anterior to the submaxillary region, a T-shaped incision is very advantageous, the shorter limb extending from the mandible to the hyoid bone. Short incisions, 1 to 2 inches (2.5 to 5 cm.) long, are theoretically unsound and usually prove inadequate. Intraoral incisions fail to give the necessary decompression for the tension in the sublingual tissue, and it is impossible to keep them clean. Such incisions, made for cosmetic reasons, have no place with so serious a malady.

Radical surgical procedures as described are bound to decrease the indications for a tracheotomy in many cases. However, when the respiratory obstruction becomes evident by increasing dyspnea, a tracheotomy should be performed. After the tracheotomy is done, secretions in the trachea should be removed by continuous suction until swelling in the floor of the mouth has subsided sufficiently to allow free expectoration of secretions.

The incisions should be kept open by rubber tubing or by other effective means of drainage and covered with fluffed gauze soaked with hypertonic solutions of sodium chloride. These dressings should be changed frequently, or as often as they become soiled. The incisions and drainage tubes should be irrigated several times daily with physiologic solution of sodium cholride. Harvey and Muskleston [1] stated that too much stress cannot be placed on the efficacy of hot fomentations changed every fifteen minutes and used just as soon as the patient returns from the operating room, and continuously until the tissues of the neck resume their normal conditions. Hot fomentations may favor resolution and should supplement surgical drainage.

Supportive treatment is to combat the impending or accompanying sepsis. The fluid intake is greatly enhanced by the difficulty of swallowing and by severe toxemia. Fluids should be administered intravenously, hypodermatically, by proctoclysis or by retention enemas. Dextrose should also be given intravenously or by rectum (probably only a small amount is absorbed by this route) to overcome the toxemia and acidosis.

Most authorities do not believe that intravenous drug therapy has any decided advantage in combating the bacteremia; however, a few have reported good results.

Serums are also advocated by some writers. Polyvalent antistreptococcus or antistaphylococcus serums are to be preferred. They may be given intramuscularly or intravenously; the latter route is to be preferred, the serum being given with a large quantity of physiologic solution of sodium chloride. The amount of serum given varies from 20 to 100 cc. It is always advisable to test the sensitivity and, if necessary, to desensitize the patient before the serum is given. It is best to give the serum during a two or three day period because the patient

will be becoming sensitive to the foreign protein of the serum and the danger of anaphylaxis becomes greater.

In the very early stages, before the time of pus formation, the administration of serums and intravenous drugs may be effective to abort the full development of the disease. However, after pus has formed it is doubtful whether these methods have any effect on the course of the disease.

Symptomatic drug therapy should also be used as indicated. Antipyretics, alkalis, stimulants and drugs acting on the heart may prolong the course to some extent. The administration of oxygen proves advantageous at the onset of respiratory obstruction.

The prognosis of Ludwig's angina varies according to the virulence of the infection and therefore according to the rapidity with which the mouth and pharynx are crowded and the larynx is reached by the inflammatory process. The prognosis also depends on the promptness with which the condition is recognized and on the thoroughness of the treatment.

SUMMARY

The history of this condition dates back to the time of Hippocrates.

Ludwig's classic description of the disease has had little added to it to the present time. There are two types of the disease, primary and secondary, the primary being a perilymphadenitis and the secondary an infection of the lymph glands which may simulate the primary type.

The most predominating etiologic factor in the primary type is caries of the teeth or dental surgical intervention.

The causative micro-organism may be one of several.

The treatment of the primary type is purely surgical and early at that, followed by supportive treatment and plenty of fluids. At present the use of one of the sulfonamide group of drugs should be strongly encouraged. The drug to be used should depend on the bacteriologic findings.

If respiratory difficulty arises a tracheotomy should be done. The postoperative care of the wound should be as follows: Dressings should be moistened in hypertonic solution of sodium chloride and changed frequently to allow for drainage of the tissues.

The prognosis is favorable provided early and adequate surgical procedures are carried out.

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BONE REPAIR FOLLOWING DEFECTS MADE IN THE SKULL OF CATS BY MEANS OF DIFFERENT INSTRUMENTS

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Otologists have shown an ever increasing interest in examining the fundamental morphologic response which occurs in bone after injury by the use of various instruments. More and more clinicians are going back to the laboratory to test the hypotheses which direct their efforts in dealing with the difficult problem of otosclerosis. Recently, for example, attempts have been made to determine the histologic changes which take place in injury of the periosteal bone by different instruments. Canfield [1] made defects with sharp and dull instruments in the skull of the cat, and his observations on 2 week old specimens led him to state:

> The defect cut with the sharp saw was partially filled with fibrous tissue, with many osteoblasts producing new bone. The defect made with dull drill showed, however, almost no fibrous tissue, no new bone and almost no osteoblasts. Sections of the defects made with a sharp cutting burr and a polishing stone showed the same variations.

This conclusion left the impression that the polishing and burnishing burrs were capable of preventing bone regeneration. This statement is at variance with the clinical findings of one of us (J. L.),[2] whose work on hundreds of human labyrinths has shown that osteogenesis can occur after fenestration of the external semicircular canal in spite of the fact that the fenestra was always made with polishing and burnishing burrs.

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1. Canfield, N.: Labyrinthine Fistulas: Report of Experiments on the Vital Response to Various Methods of Producing Defects in Bone, Arch. Otolaryng. **30**:50 (July) 1939.

2. Lempert, J.: Endaural Fenestration of External Semicircular Canal for Restoration of Hearing in Cases of Otosclerosis, Arch. Otolaryng. **31**:711 (May) 1940; Endaural Fenestration of the Horizontal Semicircular Canal for Otosclerosis, Laryngoscope **51**:330 (April) 1941.

The Guggenheims [3] carried out a series of experiments on the skulls of adult white rabbits and created defects by means of sharp and dull instruments. These investigators reported that two months and two days after operation, the most patent fistula was that made with a sharp instrument. Next came the fistula made with the burnishing burr and completed by electrocoagulation, while that made with the burnishing burr alone showed the largest amount of new bone formation. In view of such opposing conclusions reached by Canfield and the Guggenheims as a result of experiments performed on periosteal bone, we undertook the following experiments to test their validity.

MATERIAL AND METHODS

This report is based on the study of 12 cats, the postoperative ages of which were 7, 13, 14, 15, 20, 21, 22, 29, 34, 39, 42 and 46 days, respectively. Defects in the skulls of these animals were made under the usual aseptic conditions by means of the curet, a sharp no. 10 dental burr, a no. 12 gold polishing burr and a 5/8 inch (1.6 cm.) disklike, circular saw mounted on a dental mandrel. A high speed dental motor was used to rotate the burrs and the saw. The depth of the bony defect was not uniform. In some cases it extended well into the diploic spaces; in all it extended through the outer cortex of the skull. The walls of the defects on the right side were burnished for two minutes with a smooth steel ball-shaped burr. The burnishing burr was kept in contact with the defect for approximately five to six seconds, was removed for about the same length of time and then was replaced, and so on, for the two minute period. Even with this precaution the heat generated by the friction of the smooth burr was sufficient to cause a slight discoloration of the bone. Soluble pentobarbital U. S. P. was used to induce anesthesia; the amount varied, but usually 2.5 cc. was sufficient to permit the operation without interference. At varying periods the animals were again anesthetized and sections of the skull removed which contained all defects on the one piece of bone.[4] These specimens were immediately placed in Heidenhain-Susa fixative solution. The decalcification was accomplished by means of 5 per cent trichloroacetic acid. The bones were subsequently cleared through methyl benzoate and 1 per cent pyroxylin, infiltrated with paraffin, and the sections stained with hematoxylin and eosin and the Mallory technic.

OBSERVATIONS

The present report is primarily a histologic description of the lesions made with the polishing burr, inasmuch as it is generally conceded that new bone formation takes place after injuries with the curet, the saw and the sharp burr.

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3. Guggenheim, L. K., and Guggenheim, P.: Artificial Fistula in Otosclerosis, Tr. Am. Laryng., Rhin. & Otol. Soc. **46**:509, 1940; Arch. Otolaryng. **32**:1 (July) 1940.

4. The facilities of the animal room at the Massachusetts Eye and Ear Infirmary were made available to us through Dr. Leroy Schall, Chief of the Ear, Nose and Throat Department.

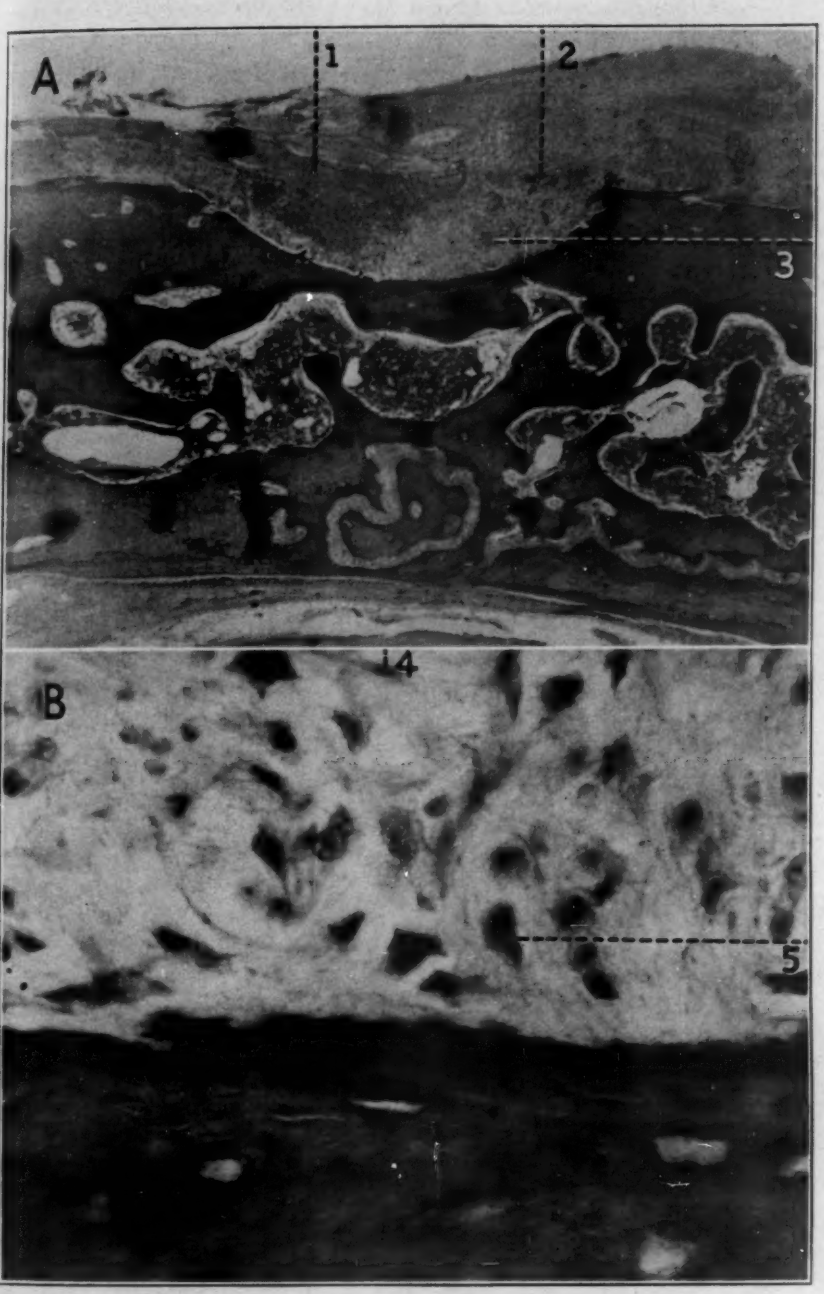

Fig. 1 (seven days after operation).—Burnished lesion made with polishing burr. *A*, × 26; *B*, × 720.

Seven Day Postoperative Lesion (fig. 1).—The general picture was one showing areas of connective tissue becoming transformed into osteogenic tissue. At *3* (fig. 1) numerous cells which are characterized

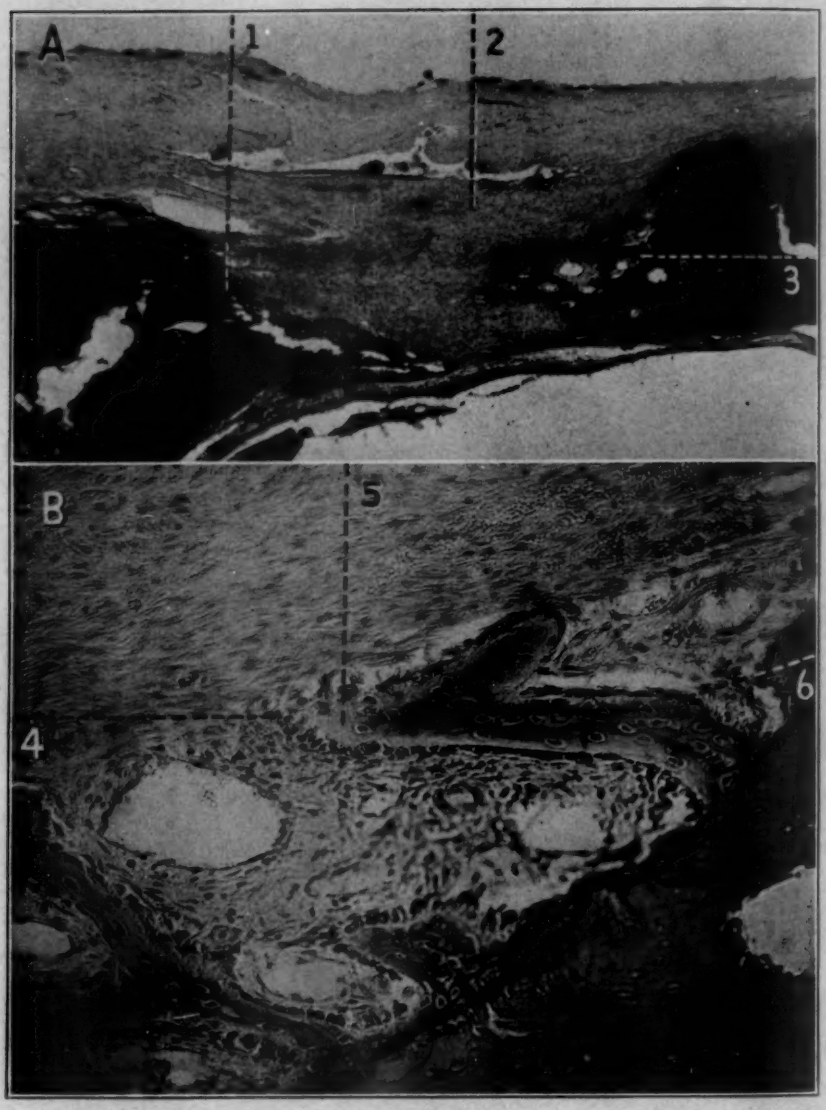

Fig. 2 (fourteen days after operation).—Burnished lesion made with polishing burr. *A*, × 26; *B*, × 178.

by the cytoplasm's being drawn out into tadpole-like processes and the eccentric position of the nucleus give evidence of the transformation

of fibroblasts into osteoblasts. Fibrin and blood cells are seen at *1*, and at *2* are several areas where bone chips are undergoing necrosis. A typical fibroblast is seen at *4* and a characteristic osteoblast at *5*.

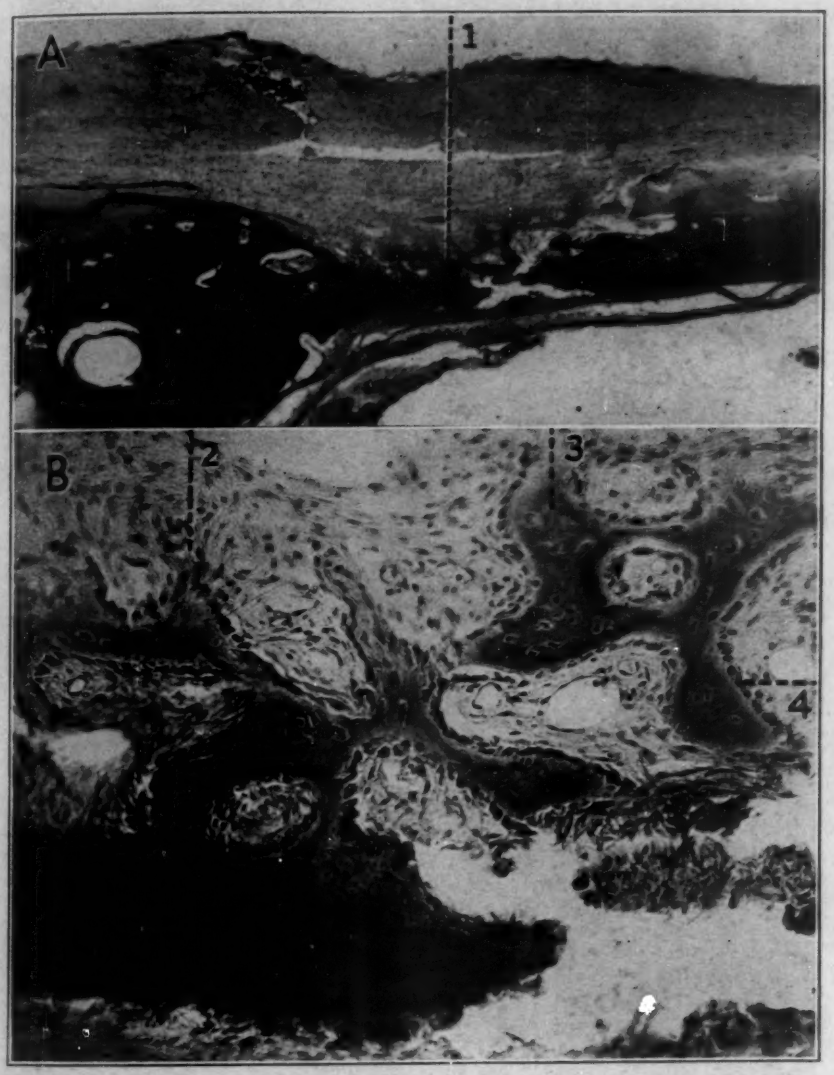

Fig. 3 (fourteen days after operation).—Burnished lesion made with polishing burr. *A*, × 26; *B*, × 178.

Fourteen Day Postoperative Lesions (figs. 2 and 3).—The picture in figure 2 is one of active trabecular bone formation proceeding centripetally from the margins of the lesion, at *1* and *3;* at *2* a portion of the

Fig. 4 (twenty-one days after operation).—Unburnished lesion made with curet. *A*, × 26; *B*, × 178.

periosteum, rich in fibrous and cellular elements, may be seen. The osteoblasts at *4* surround a light-stained osteoid matrix, labeled *5*. These osteoblasts become continuous at *6* with similar osteoblasts sit-

Fig. 5 (twenty-one days after operation).—Burnished lesion made with curet. *A*, × 26; *B*, × 178.

uated along the edge of the darker-staining, older bone, which is here separated from the new bone by a sharply demarcated, blue line. Figure 3 *B*, which is an enlargement of area *1* in *A*, gives a clear picture

of the transformation of fibroblasts into osteoblasts in the region labeled *2*. Osteocytes completely filling their lacunas are shown at *3*. The typical epithelioid arrangement of osteoblasts is shown at *4*. It should also

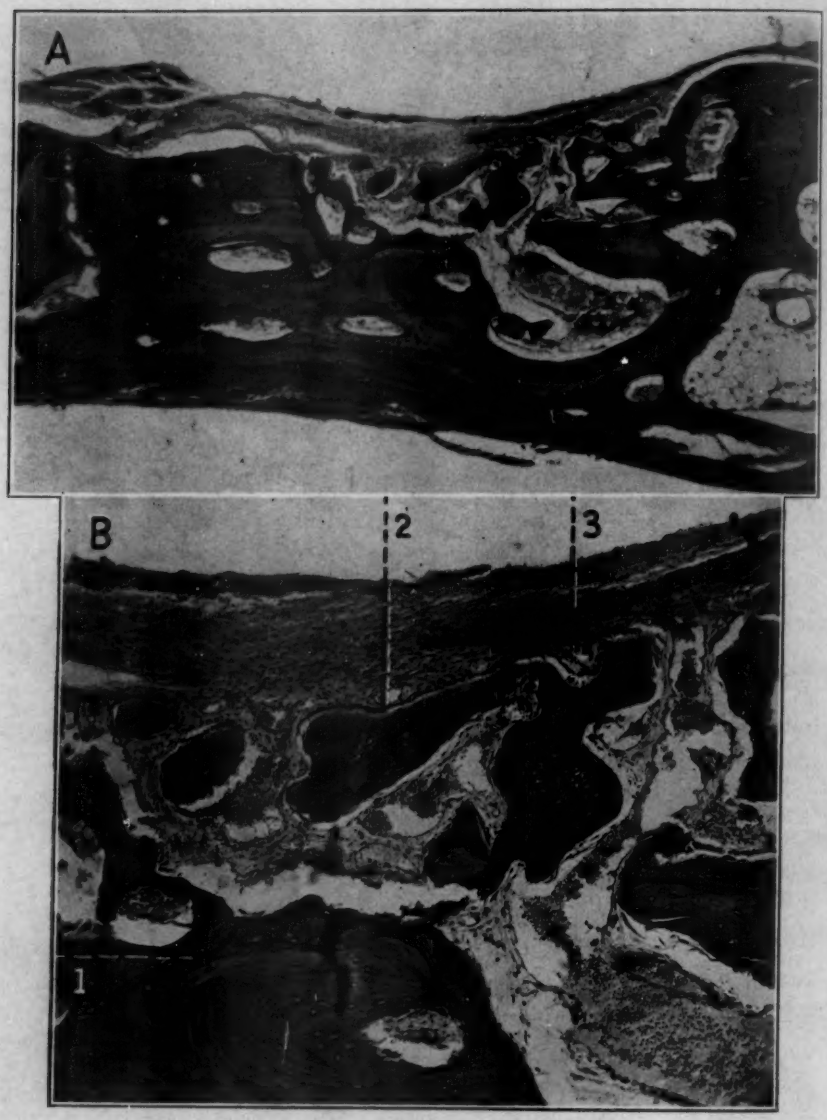

Fig. 6 (twenty-one days after operation).—Unburnished lesion made with saw. *A*, × 26; *B*, × 72.

be observed that areas of osteogenic hematopoietic tissue are being surrounded by bone to form haversian canals.

Twenty-One Day Postoperative Lesion.—It seems desirable to introduce here twelve photomicrographs to show the response of bone growth to injury by the various instruments used to produce the lesions. The striking feature to be noted is that osteoblastic activity takes place in the unburnished as well as in the burnished lesions.

Curet: Unburnished lesion (fig. 4): Spicules of new-formed bone are seen at *1*. The elements in the active fibrocellular layer at *3* pass through the intermediate stages indicated at *2* before becoming the clear-cut osteoblasts surrounding the spicules of bone. The growing tip of the bone trabecula marked *4* and its close association with the spindle-shaped cells just beyond it give a clear picture of the activity going on.

Burnished lesion (fig. 5): Here an interesting section is presented, showing active osteoblasts at *1* and the transition forms of spindle-shaped fibroblasts into osteoblasts at *2*. The inclusion of many cells into the osseous matrix to form osteocytes is seen at *4*. The numeral *3* points to areas of bone chips undergoing disintegration.

Saw: Unburnished lesion (fig. 6): The cement line separating new bone from old bone is seen at *1;* the phalanx arrangement of osteoblasts is evident at *2*, and a band of osteogenic fibers and cells, at *3*.

Burnished lesion (fig. 7): One observes at *2* an intense transformation of fibroblasts into osteoblasts, which are in the process of laying down new bone at *1* and at *3*.

Sharp Burr: Unburnished lesion (fig. 8): The separation of old from new bone is seen between *1* and *2;* again, at *3* there is evidence of acute osteoblastic activity.

Burnished lesion (fig. 9): Here, too, the continuity between the old and the new bone is seen between *1* and *2*. An important band of connective tissue marked *3* is observed running into an area of cells, which at *4* are changing from fibroblasts into osteoblasts.

Polishing Burr: Unburnished lesion (fig. 10): Strands of spindle-shaped cells are becoming modified into osteoblasts in juxtaposition with the old bone, as indicated at *1* and at *3*. A finger-like process of osteogenic tissue is seen at *2*.

Burnished lesion (fig. 11): Osteoblastic activity is conspicuous about the apex of the bone trabeculae at *5, 7* and *8*. The line of demarcation between old and new bone is seen at *6*. Foreign body reaction is indicated at *1; 2* indicates the site which is enlarged in *B;* a fibrous mass is seen at *3*, and at *4* is an area of new bone formation.

Twenty-Nine Day Postoperative Lesion (fig. 12).—It is clear that new bone growth is taking place in the unburnished, as well as in the

Fig. 7 (twenty-one days after operation).—Burnished lesion made with saw. *A*, × 26; *B*, × 178.

burnished, lesion. There is a considerable vascularity of the tissues. Again, the transition forms between spindle-shaped cells and osteoblasts are indicated by various numerals.

Thirty-Nine Day Postoperative Lesion (fig. 13).—An important contrast is afforded in the periosteum covering the lesions shown in *A* and *B*.

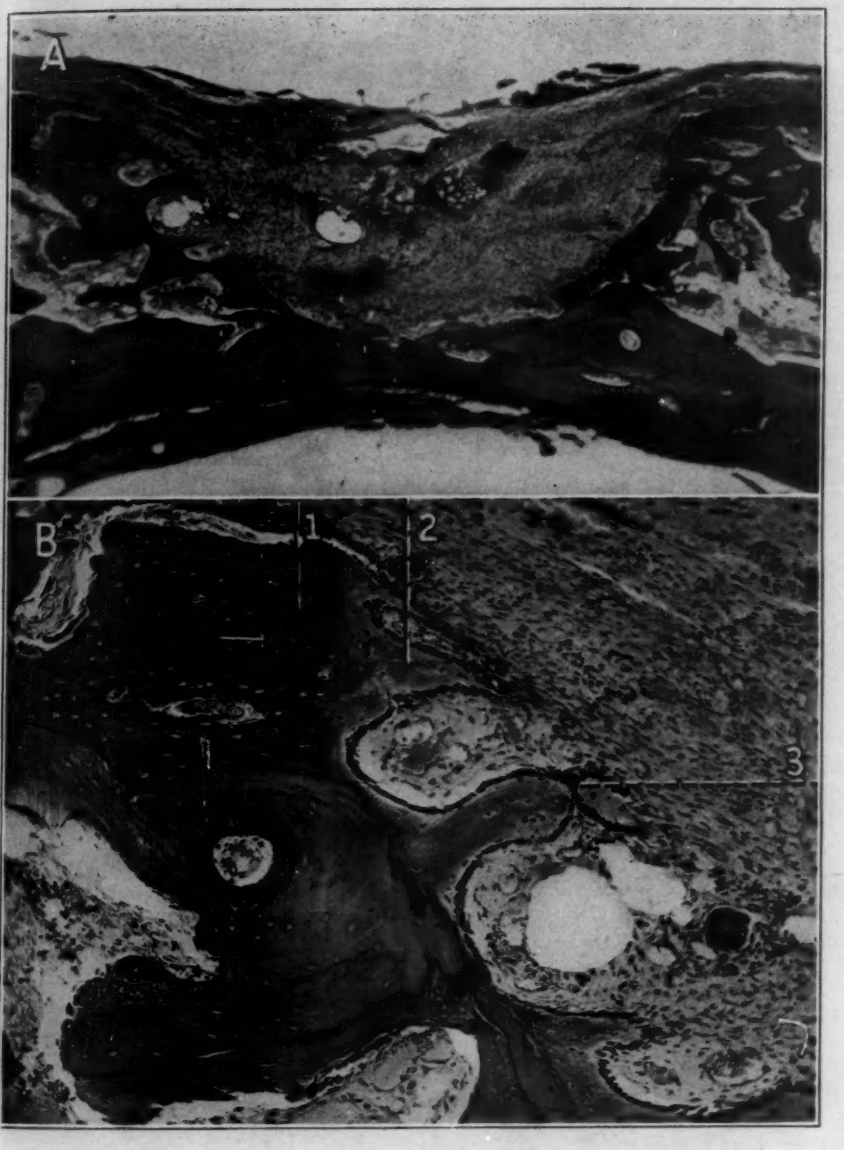

Fig. 8 (twenty days after operation).—Unburnished lesion made with sharp burr. *A*, × 26; *B*, × 178.

In the burnished lesion the periosteum at *1* is seen to be a layer of welded fibers applied to the bone at *2*, the lamella of bone being separated from

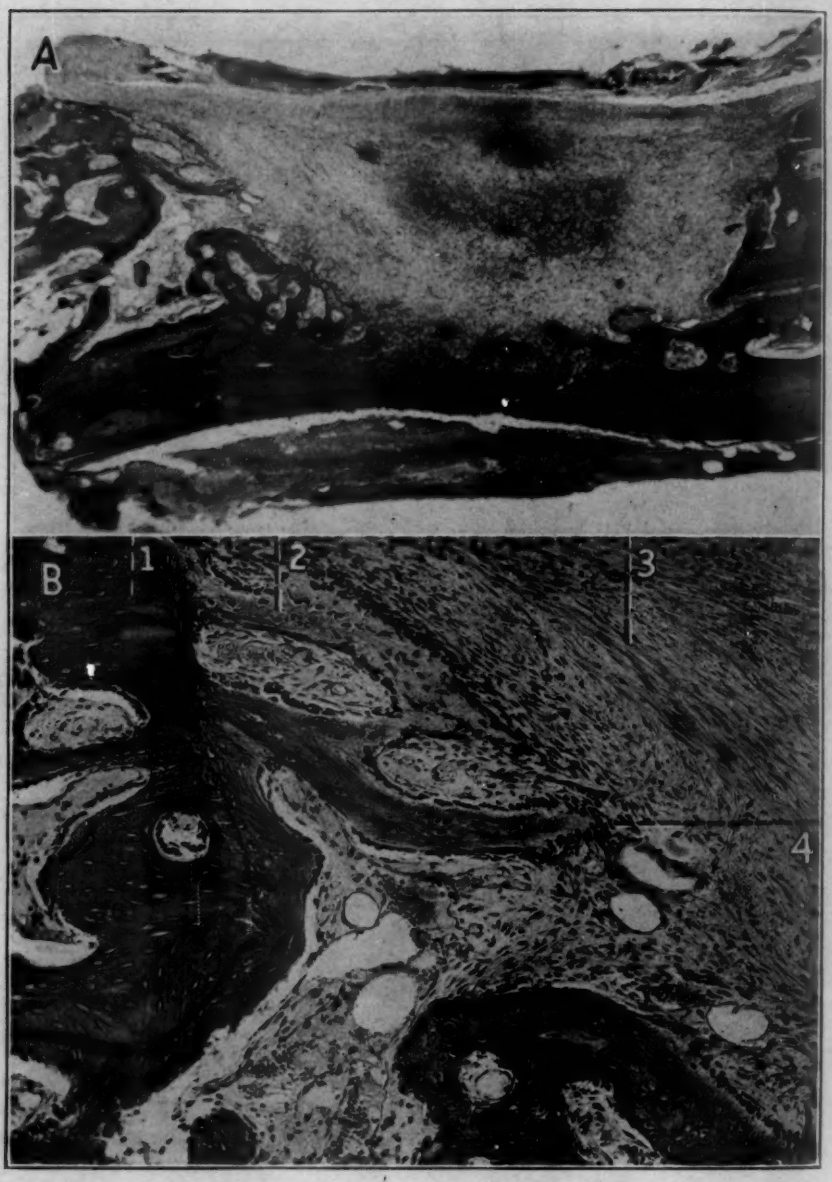

Fig. 9 (twenty-one days after operation).—Burnished lesion made with sharp burr. *A*, × 26; *B*, × 178.

the underlying old bone by a retraction space. In the unburnished lesion, however, the periosteum is the loose fibrocellular layer, showing

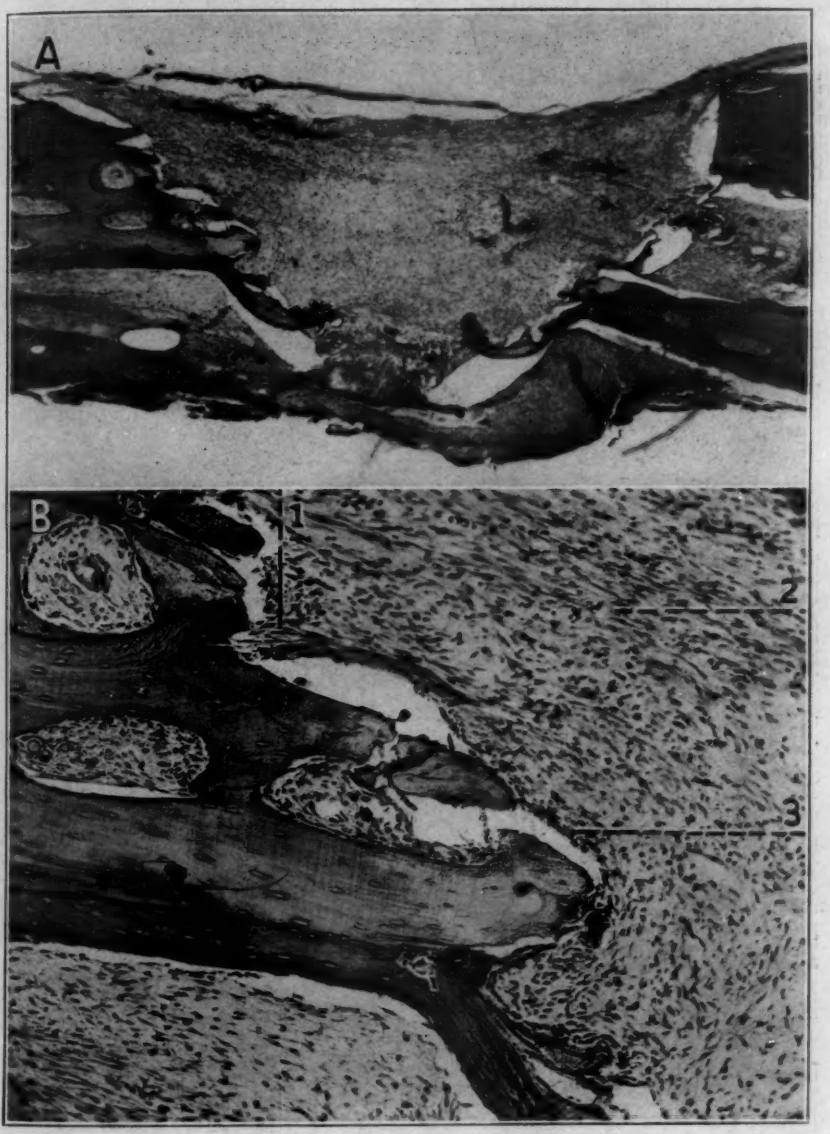

Fig. 10 (twenty-one days after operation).—Unburnished lesion made with polishing burr. *A*, × 26; *B*, × 178.

again the transformation of fibroblasts, *6*, into osteoblasts at *5* and at *7*. Its contact with the old bone at *4* is noted.

Firty-Six Day Postoperative Lesion (fig. 14).— This picture is similar to that of the 39 day cat. The retraction space is seen at *1* and *8*. A clear picture of the transformation of fibroblasts into osteoblasts is shown at *2, 3, 5, 6* and *7*. Along the surface of the trabeculae of bone some of the spindle-shaped cells are actually osteoblasts.

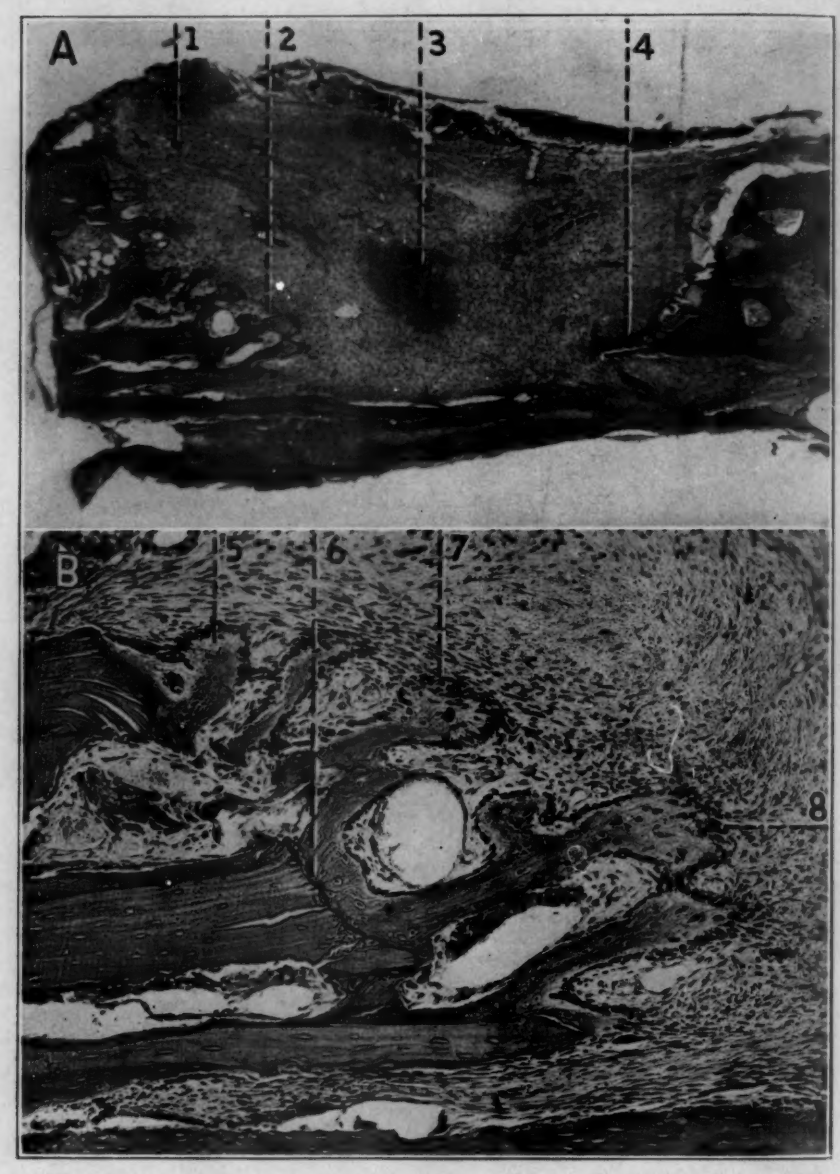

Fig. 11 (twenty-one days after operation).—Burnished lesion made with polishing burr. *A*, × 26; *B*, × 178.

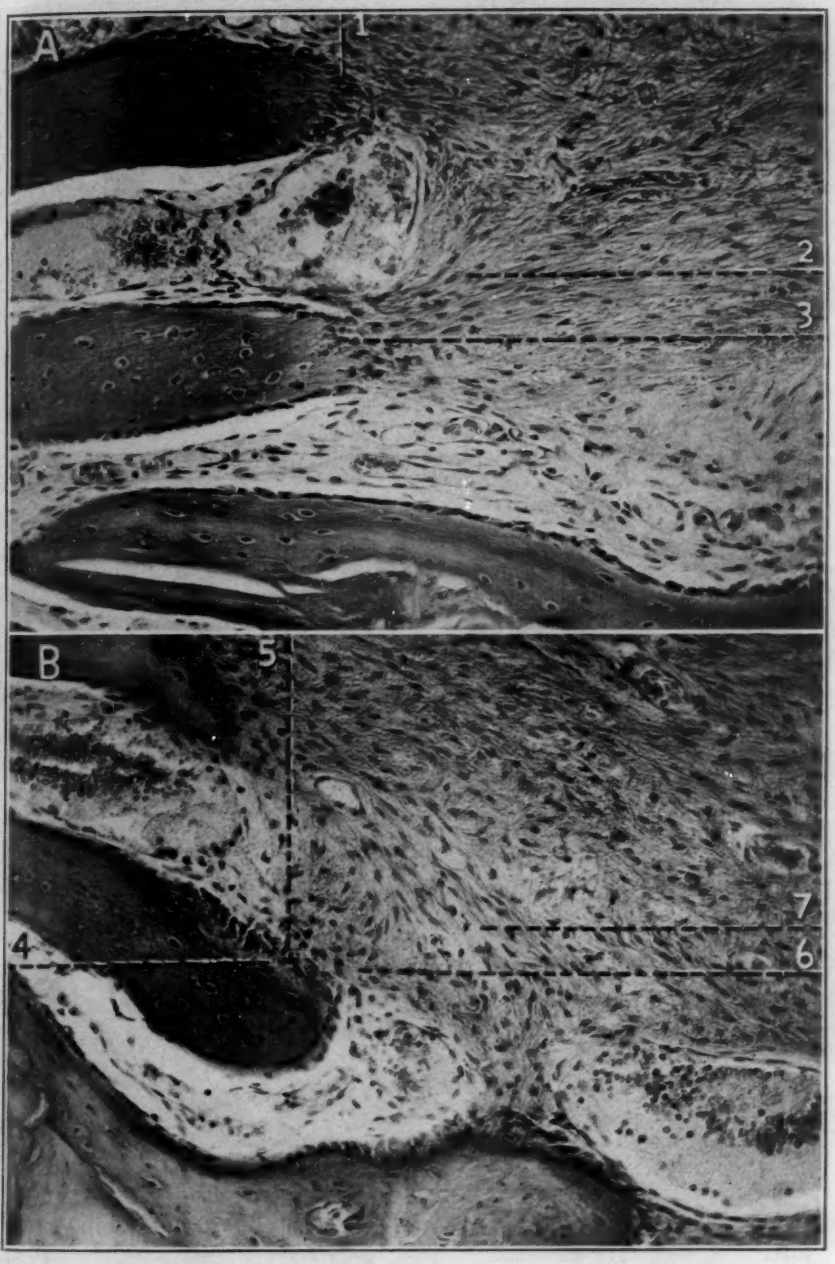

Fig. 12 (twenty-nine days after operation).—Lesions made with polishing burr. *A*, burnished; *B*, unburnished. × 178.

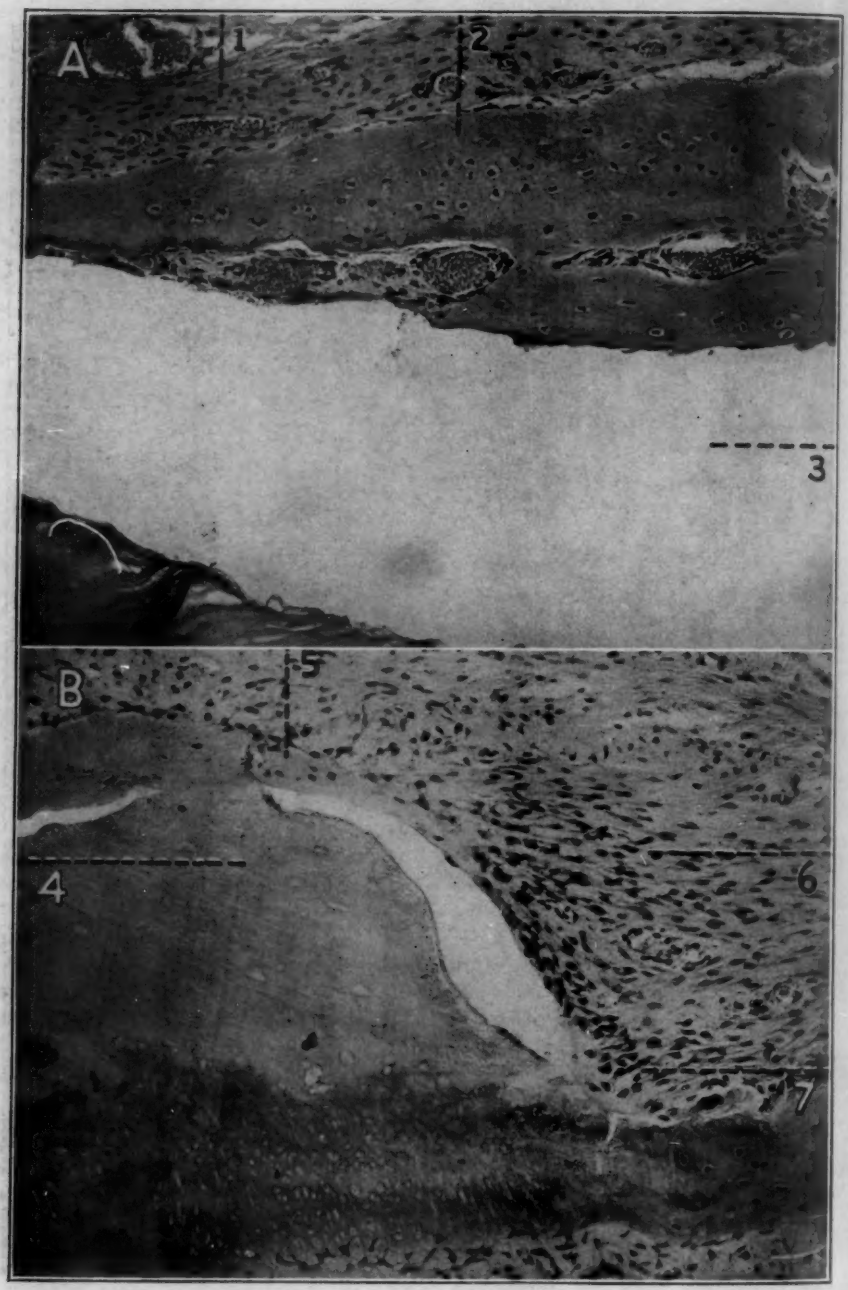

Fig. 13 (thirty-nine days after operation).—Lesions made with polishing burr. *A*, burnished; *B*, unburnished. × 178.

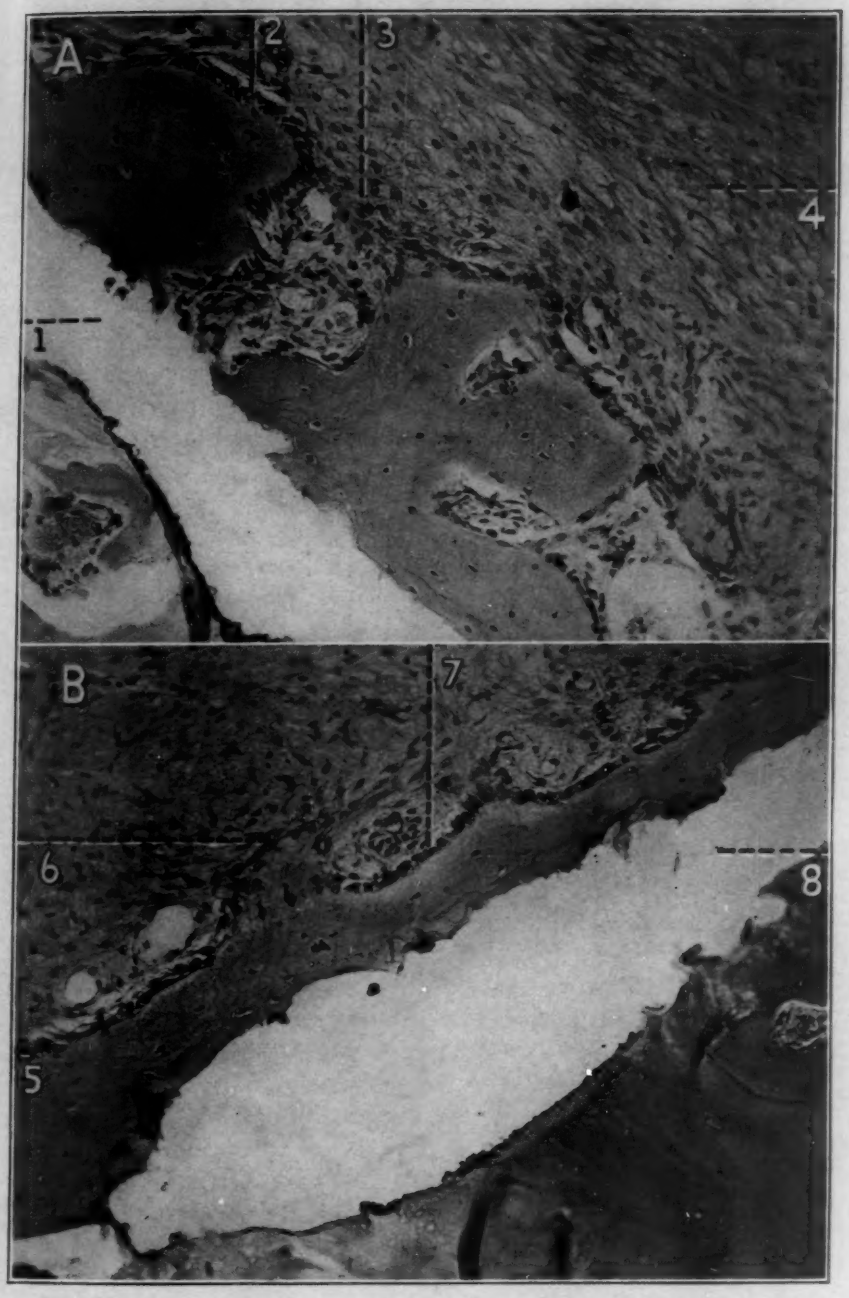

Fig. 14 (forty-six days after operation).—Lesions made with dull burr. *A*, burnished; *B*, unburnished. × 178.

CONCLUSIONS

From experiments carried out on the skulls of 12 cats ranging in postoperative age from 7 to 46 days, in which lesions were produced by different instruments, the following conclusions were arrived at:

1. Given sufficient time, growth of new bone will take place in lesions made with any type of instrumentation; that is, we believe that no single instrument used to create a defect in the periosteal bone of the skull of either the cat or the rabbit is capable of inhibiting completely the natural tendency toward bone regeneration.

2. Our findings fail to substantiate either the conclusions of Canfield or those of the Guggenheims. From the results of our experiments we are led to suspect that the burnishing and polishing burrs tend to retard and inhibit the osteogenesis, but in none of our experiments did these instruments succeed in entirely preventing new bone regeneration.

3. Our results, as well as those of Canfield and the Guggenheims, cannot without caution be carried over *in toto* in the interpretation of what takes place in fenestration of the horizontal semicircular canal of the human labyrinth. Though one of us (J. L.) can point to hundreds of operations on the human labyrinth in which the polishing and burnishing burrs were employed to create the fenestra in the external semicircular canal and such fenestras remained patent because osteogenesis did not take place, he does not believe that the use of these burrs was the sole reason for the failure of bone regeneration to take place in these cases. Further investigation of this problem is now being conducted on the monkey labyrinth.

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LARYNGOTRACHEOBRONCHITIS IN CHILDREN

CLASSIFICATION AND DIFFERENTIAL DIAGNOSIS

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In recent years, many articles have appeared in the literature of otolaryngology concerning infectious laryngotracheobronchitis. Most authors are now well agreed on the characteristics of this disease, its prevalence and its high mortality rate, especially among infants and young children. It seems that the battle of titles and descriptive adjectives, such as fulminating, nondiphtheritic and pseudomembranous, has quieted down, and one may hopefully expect less confusion in the future, especially for the younger men who are interested in the literature of this most fascinating and deadly disease. Treatment has been fairly well standardized, and there have not been many additions of any great importance in recent years, not excepting the sulfonamide drugs. In other words, most of the articles appearing at present have similar subject matter and almost identical conclusions. It seems, then, that the place may have been reached where further discussion of the subject in the meetings of the specialty is not as necessary as it was ten, fifteen or twenty years ago. In earlier years otolaryngologists must surely have been seeing cases of this disease, but undoubtedly in many instances they were treating the condition as diphtheria. There is no particular reason that a symptom complex which is apparently caused by one or more of the various organisms common to all infections of the respiratory tract should suddenly become prevalent and continue to appear in scattered localities all over the world.

However, in view of the seriousness of this disease, too much probably cannot be written about it, especially if the material appears in publications which are available to general physicians and pediatricians. After all, these physicians see most of the patients first, and unless they are alive to the nature of the condition and the seriousness of watchful waiting and purely medical treatment, laryngologists may not see many of these patients, or at least may not see them in time to carry out proper treatment. Even now, many good otolaryngologists with big practices admit that they see few such patients and are at a loss to explain the great variation and prevalence of the disease in various parts of the country. Having been greatly interested in infec-

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tious laryngotracheobronchitis since 1920, and having followed the literature carefully, I have received the impression that the condition is recognized and reported in a considerable number of cases only in the localities where the otolaryngologists have been definitely interested themselves and have consequently stimulated interest and respect for the disease among the general physicians and pediatricians. In my personal experience of twenty-two years, I have not seen this disease appear in epidemic form, but one or more patients with a serious form of the disease have been cared for each year.

My main interest in writing this paper is to stress the differential diagnosis and classification of acute laryngotracheobronchitis, for it is possible that in recent years so much stress has been put on treatment of the serious infectious types that differential diagnosis has been shunted into the background. I hasten to add that this emphasis on the treatment of the serious types has been important and necessary, and I myself have written three or four papers since 1926 emphasizing this importance and necessity. I feel, however, that differential diagnosis should be given more attention, without in any way interfering with the proper treatment in the serious cases. If we otolaryngologists coach ourselves and our general physicians and pediatricians too constantly on the one serious type, it is possible that sometimes other, milder forms of laryngotracheobronchitis may be subjected to more radical treatment than is necessary. Again, certain time-tried specific measures, such as diphtheria antitoxin, may be relegated to a secondary position they do not deserve.

CLASSIFICATION

I. Infectious types
   - A. Nonspecific: Streptococcic, staphylococcic, influenzal, pneumococcic, etc.
   - B. Specific: diphtheria

II. Traumatic types
   - A. With demonstrable foreign body
   - B. Without demonstrable foreign body
     1. Particles of solid matter in mucus, too small to be identified (possibly peanut, popcorn, foods)
     2. Liquids—oils (nose drops), medicines, milk, chemicals

III. Allergic types
   - A. Edema (angioneurotic)
   - B. Asthma

IV. Spasmodic types (croup)

LARYNGEAL DIPHTHERIA

This disease is uncommon at present in contrast to its prevalence fifteen or twenty years ago. However, cases still appear, and it is possible that the condition may be treated as nondiphtheritic if a proper differential diagnosis is not made. This, of course, is a reversal of the procedure of fifteen or twenty years ago. Only a few months ago I lost a patient after tracheotomy with typical old-fashioned diphtheria, which involved the tonsils, pharynx, soft palate and larynx. This patient had been under the observation of a general physician for three or four days, and no antitoxin had been given. I feel sure that the fact that my associates and I had stressed the prevalence and seriousness of the nondiphtheritic types so consistently in our community had led this physician into the error of not considering the possibility of diphtheria seriously enough to have given antitoxin early. It has been my practice all through the years to give antitoxin early and in large doses in any even mildly suspicious case until a definite diagnosis has been made. I still feel that this is a safe procedure for one to advise when talking to or consulting with general physicians and pediatricians, for apparently no harm results from giving antitoxin and the possible foreign protein reaction is probably helpful, even in cases of the nondiphtheritic infections.

TRAUMATIC LARYNGOTRACHEOBRONCHITIS

Nothing will be said in this paper concerning laryngotracheobronchitis secondary to a demonstrable foreign body because this subject has been thoroughly covered in the literature for many years by eminent authorities. Much could be said concerning problems of differential diagnosis, but such a discussion is not within the scope of this paper.

I am using this title to refer especially to the case in which the history and physical findings, often including roentgenographic and laboratory evidence, suggest the presence of a foreign body in the respiratory tract. Although no demonstrable foreign body other than collections of mucus is found on bronchoscopy, this mucus at times forms in sticky plugs in the bronchi which are as obstructive as any foreign body. During a period of seventeen months in 1938 and 1939, 8 consecutive patients from 1 to 2 years of age came under my care because of a possible foreign body in the air passages, but no foreign body was demonstrable on bronchoscopy. During the past few years there have been 5 others with similar findings, so that I can now report on 13 cases which have been carefully followed for months and years. In each instance there was a fairly definite history of sudden onset of choking, followed by varying degrees of stridor, cough, wheezing and cyanosis, in a child with no

evident previous respiratory symptoms. Popcorn, peanuts, coffee beans, field corn and watermelon seeds were some of the materials which were found in the mouths of these children when the symptoms of acute respiratory disturbance developed. In 1 instance it is likely that kerosene was inhaled. It is possible that milk, medicine, nasal oils or chemicals may enter the respiratory tract of infants and young children and set up the clinical picture which is usually associated with the presence of a demonstrable foreign body.

In all cases in this group, on admission to the hospital there was some degree of dyspnea, with various grades of suprasternal and infrasternal retraction, wheezing respiration, cough and cyanosis. Deficient breath sounds over a tympanic lung suggested ball-valve obstructive emphysema in several chests; deficient breath sounds over areas of dulness suggested atelectasis in others. The temperatures on entrance to the hospital ranged from normal to 104 F., and the leukocyte count of the blood, from normal to 39,000 per cubic millimeter. Roentgenographic evidence suggested ball-valve emphysema in 2 cases, pneumonitis or atelectasis in 3 cases and nothing significant in several others; in 2 cases the roentgenograms were not satisfactory. The patients in this series came under observation in from two hours to three weeks after the onset of symptoms of acute respiratory distress.

Bronchoscopy, done in each of the 13 cases without anesthesia and without preliminary tracheotomy, revealed no demonstrable foreign body. It is likely that pieces of material too small to be identified were present in the mucus or had been drawn deep into the smaller bronchial divisions. In each case mucus, sometimes in sticky masses or plugs, was removed by suction through the bronchoscope from the trachea and from one or both bronchi. In 1 case a child 2 years of age came under observation ten days after the original choking spell, which occurred while there were portions of peanut in the mouth; bronchoscopy showed a plug of white, sticky mucus practically obstructing a main bronchus. In this case a second examination was necessary eight days later to remove a similar plug. From then on there were rapid cessation of respiratory symptoms and clearing of the roentgen evidence of atelectasis. In 1 case tracheotomy was necessary about twenty-four hours after bronchoscopy. In this case decannulation was done six days later, and the patient made a complete and rapid recovery, without showing any evidence of descending involvement of the respiratory tract, such as is encountered in cases of the infectious type.

Complete recovery occurred in all 13 cases, without sequelae. In 6 cases the patient was dismissed from the hospital within four days after admission, and in 1, after eight days; the 1 case previously mentioned in

which a second bronchoscopy was necessary and the 1 case in which tracheotomy was performed were under observation twelve days.

Comment.—This group of cases is reported not with the idea that such conditions are rare, but rather to emphasize the possibilities of bronchoscopy in the treatment of certain types of tracheobronchitis in which no foreign body is demonstrable. The results after the removal of mucus by suction were just as good as in the case of the ordinary foreign body, in which the operator has a real specimen to show for his efforts.

It is possible that unless a good history is obtained, some patients with traumatic tracheobronchitis will be thought to have the infectious form and will be treated accordingly. Tracheotomy was necessary in only 1 of the 13 cases, while, of course, such a procedure would be necessary in a much higher percentage of instances of the infectious type. There have been some reports in the literature of a mortality rate for infectious laryngotracheobronchitis of only 25 or 17 per cent, or even 11 per cent. However, most writers who have had long experience with this dreaded disease feel that a recovery rate even of 50 per cent over a number of years is hard to achieve. It is possible that in a group of cases which could be handled with such a low mortality rate as that just mentioned, the obstructive symptoms were of traumatic, rather than of infectious, origin in some instances.

ASTHMA AND ALLERGIC LARYNGOTRACHEOBRONCHITIS

These conditions are probably not common in infants, but occasionally they may be confused with the infectious form. Here, too, the confusion is probably more likely to come in a community where a laryngologist has laid great stress on the prevalence and seriousness of the infectious type. Just a few days ago I saw a 19 month old son of a general physician. Rapid, noisy respiration had rather suddenly developed after an infection of the nose and throat. There were restlessness, dyspnea, refusal of food, fever and moderate cyanosis, which, of course, are prominent danger signals in the descending infectious type. In this instance, even with some signs of dyspnea, there was practically no retraction, either suprasternal or infrasternal, but a definite wheeze was present, and sometimes a slight grunt on expiration. Breath sounds were heard over both lungs, but there were more musical rales than is usual in cases of the infectious type. There was an indefinite history of an allergic tendency in the family, but none in the patient. A probable diagnosis of bronchopneumonia was made by the consulting pediatrician. Because of these signs, i. e., the expiratory wheeze with slight inspiratory retraction, small doses of epinephrine were given twice during the night, and highly humidified air and a high fluid intake were provided. By the

next morning, dyspnea and noisy respiration, especially the expiratory wheeze, had almost disappeared, and the patient's general condition was good. Tracheotomy in this case would probably not have been serious, even if the indications had been more definite, but it certainly would have added new hazards in the lower part of the respiratory tract, with, of course, a more stormy and protracted convalescence.

About six months ago, a baby of 9 months presented a picture similar to that in the preceding case, except that there was more suprasternal and infrasternal retraction and the added problem of the short, fat neck of the younger child was present. In this instance, the expiratory wheeze, which suggested the possibility of asthma, led me to give epinephrine and to keep the patient under observation. With administration of two small doses of this drug during the one night, the symptoms had all disappeared by morning. The patient was dismissed from the hospital and had no further respiratory symptoms.

I wish to emphasize that I should not advise or carry out such a program of watchful waiting as was used in these 2 cases except in a hospital where everything is available and ready for immediate bronchoscopy and tracheotomy.

SPASM OF THE LARYNX

"Spasmodic croup" refers to episodes of sudden dyspnea which are dramatic and fearful, but are usually of short duration and not commonly dangerous to life. Most of the patients who suffer with this condition are not seen by the laryngologist, and in many instances even the family physician arrives at the home too late to share in the short period of terrifying helplessness experienced by the parents. Fortunately, the symptoms are usually produced by spasm of the vocal cords in an otherwise healthy larynx, and relief comes automatically as the result of a physiologic phenomenon. It is rare for these spasmodic attacks to come on except during the night, and usually the patient is as well as ever the following day. If, however, symptoms which are attributed to spasm of the larynx, namely, dyspnea, hoarse cough, croupy cry and noisy respiration, persist during the daylight hours, it behooves the medical attendant to consider the possibility of a real pathologic condition, probably secondary to obstruction by a foreign body or infectious laryngotracheobronchitis.

SUMMARY

In this short paper, stress is laid on the importance of classification and differential diagnosis in the consideration of acute laryngotracheobronchitis, especially as this condition, in its various manifestations, appears in infants and young children.

It is hoped that no statement may be construed by any one as indicating that I have lost any of my respect for or fear of infectious laryngotracheobronchitis, which disease carries the highest mortality rate by far of any condition encountered in my experience in the practice of laryngology during the past twenty-two years. At present our records, that is, those of Dr. J. B. Naftzger, Dr. J. E. Dvorak and myself, show that since 1920 we have encountered in private practice 37 cases of the disease of such severity that tracheotomy was performed. In this group, there were 18 recoveries and 19 deaths, a mortality rate of 51.3 per cent. Cases of the milder form, in which recovery followed medical treatment, including the employment of a croup tent, oxygen, highly humidified air, high fluid intake and sulfonamide compounds, but in which tracheotomy was not necessary, are not included in my statistics. If such cases were considered, the percentage of deaths would be false and misleading.

When the records of recent years are considered, the percentage of deaths is more encouraging. During the six year period from 1936 to 1942 there were 17 cases in which tracheotomy was performed. In this group, there were 10 recoveries and 7 deaths, a mortality rate of 41 per cent. During the past three year period, from 1939 to 1942, there were 12 cases, with 8 recoveries and 4 deaths, a mortality rate of 33.3 per cent. Naturally, we feel encouraged by this lower mortality rate in recent years, but have no less respect for this serious disease and no feeling of overconfidence that we can keep the mortality rate below 50 per cent.

It is probably needless to add that the other types of laryngotracheobronchitis mentioned in this paper, namely, the traumatic, the allergic and the spasmodic, have a low mortality rate if cared for properly. It is pertinent to add, however, that if a proper differential diagnosis is not made, in some cases these milder forms of the disease may be treated and reported as the infectious type, thereby confusing mortality rates and possibly creating false confidence in the efficacy of certain methods of treatment.

Diphtheria, though rare, still appears as a serious disease, and antitoxin should be given early in even a mildly suspicious case.

Traumatic laryngotracheobronchitis is suggested as a clinical entity. In many instances the symptoms and physical signs suggest the presence of a foreign body in the respiratory tract, but only mucus, sometimes, however, in compact sticky masses, is found on bronchoscopy. A group of 13 cases is reported. In all there was recovery, without sequelae.

In 11 cases one bronchoscopic examination was sufficient; in 1 instance a second was done, and in 1 tracheotomy was necessary twenty-four hours after bronchoscopy.

Since it is not within the scope of this paper to discuss phases of infectious laryngotracheobronchitis other than classification and differ-

ential diagnosis, several articles [1] are listed in which I have given in more detail my personal views and experiences and have referred to the writings of many other investigators.

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1. Gittins, T. R.: Membranous Laryngitis and Tracheo-Bronchitis (Non-Diphtheritic), Ann. Otol., Rhin. & Laryng. **35**:1110 (Dec.) 1926; Laryngitis and Tracheo-Bronchitis in Children: Special Reference to Non-Diphtheritic Infections, ibid. **41**:422 (June) 1932; Laryngitis and Tracheo-Bronchitis: Reference of Non-Diphtheritic Infections, ibid. **45**:1165 (Dec.) 1936.

OSTEOMA OF THE EXTERNAL AUDITORY CANAL

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Of the bony tumors of the temporal bone, those of the external auditory canal are undoubtedly the most commonly encountered by the otologist. The vast majority of these tumors of the bony canal are small exostoses situated close to the tympanic membrane; they occur either as single or as multiple growths and not infrequently are symmetric and bilateral. Large solitary bony growths occluding to a great extent the lumen of the external canal are, however, relatively infrequent. They are usually immobile, being firmly attached to the bony wall of the canal by a bony pedicle, which varies considerably in size and shape. These growths have been rightfully termed "osteomas" and have been reported by Hellmann,[1] Lillie and Williams,[2] Bányai and Janota,[3] Cocks [4] and others. Vail [5] recorded an unusual case of multiple large osteoma of both external canals. Very rarely the osteoma has no bony pedicle attachment, being united to the canal wall only by means of soft tissue; as a result, it may be partially mobile. In a careful review of the literature we could find reported only 3 such tumors with soft tissue attachments, one by Eulenstein [6] in 1899, another by Szenes [7] in 1904 and a third by Schumacher [8] in 1915.

From the Otologic Service and the Department of Laboratories of the Mount Sinai Hospital.

1. Hellmann, K.: Ueber solitäre Exostosen des äusseren Gehörganges, Ztschr. f. Ohrenh. **81**:126, 1921.

2. Lillie, H. I., and Williams, H. L., Jr.: Osteoma of the External Auditory Canal, S. Clin. North America **11**:801, 1931.

3. Bányai, J., and Janota, F.: Ein mandelformiges obturierendes Osteom des äusseren Gehörganges, Monatschr. f. Ohrenh. **67**:983, 1933.

4. Cocks, D. C.: Gestielte Exostose im äusseren Gehörgang in Folge langdaurnde Eiterung, Ztschr. f. Ohrenh. **13**:172, 1884.

5. Vail, H. H.: A Case of Multiple Osteomata of Both External Auditory Canals, J. Med. **9**:28-31, 1928.

6. Eulenstein, H.: Spongioses Osteom des knorpeliges Theiles des äusseren Gehörganges, Ztschr. f. Ohrenh. **34**:40, 1899.

7. Szenes, S.: Osteoma liberum meatus auditorii externi dextri, Arch. f. Ohrenh. **64**:7, 1904.

8. Schumacher, H.: Eine freigewordene Exostose im Bereiche des knöchernen Gehörganges mit häutigem Stiele, Monatschr. f. Ohrenh. **49**:14, 1915.

Osteoma of the mastoid bone proper has also occurred infrequently enough to warrant its report by various otologists. Thus, within the past three years case reports by Coates,[9] Friedberg,[10] Stuart [11] and Amberg [12] have appeared in the literature. Simpson,[13] in an excellent review of this subject, recently surveyed 30 reported cases and added 2 of his own. He divided the tumors into those of the mobile and those of the immobile type. Of particular interest to us are those cases in which osteoma of the mastoid process encroaches on the external canal, partially or almost totally occluding it. Two cases of this character were reported by Greene [14] in 1893. The 2 instances presented by Greene had the added feature that the tumors were partially mobile; one was lined by cartilage, the other by dense fibrous tissue.

There seems to be a diversity of opinion with regard to the origin of bony tumors of the external canal. The preponderance of evidence favors the view that they arise as fibrous tissue tumors from the periosteum lining the os tympanum and mastoid bone. Having inherent osteogenic potentialities, these fibromas undergo a form of bony metaplasia and eventually assume the character of osseous tumors (Bányai and Janota [3]; Delafield and Prudden [15]). Bányai and Janota [3] asserted that these tumors result from a disturbance in the periosteal ossification, namely, an overproduction, in the nature of a hamartoma. Fetissof (quoted by Simpson [13]) concurs in this opinion and adds that osteoblastic apposition of bone plays only a secondary role in this process of ossification.

There is also no unanimity of opinion with regard to the part played in the formation of these tumors by previous inflammation of the middle ear or by mechanical irritation to the canal wall. Thus, Hellmann,[1] Szenes [7] and Cocks [4] stated the belief that chronic suppuration of the middle ear plays a prominent role and Friedberg,[10] that trauma may be a predisposing agent. On the other hand, Simpson,[13] Brühl, Schmiegelow and Kessel (cited by Hellmann [1]) and Greene [14] expressed the opposite view, in support of which they offered as evidence the fact that in the majority of cases of osteoma no history of middle ear infection is obtained.

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9. Coates, G. M.: Osteoma Growing from Mastoid Cortex, Arch. Otolaryng. **28**:27 (July) 1938.

10. Friedberg, S. A.: Osteoma of Mastoid Process, Arch. Otolaryng. **28**:20 (July) 1938.

11. Stuart, E. A.: Osteoma of the Mastoid, Arch. Otolaryng. **31**:838 (May) 1940.

12. Amberg, E.: An Irregularly Pearl Shaped Bone Formation in the Mastoid Process, New York M. J. **92**:709, 1910.

13. Simpson, W. L.: Osteoma of the Mastoid: Report of Two Cases, Arch. Otolaryng. **32**:642 (Oct.) 1940.

14. Greene, J. O.: Osteoma of the Mastoid, Arch. Otol. **22**:280, 1893.

15. Delafield, F., and Prudden, T. M.: A Text-Book of Pathology, ed. 15, New York, William Wood & Company, 1931, p. 414.

Microscopically the osteomas vary in character from dense sclerotic bone to soft spongy bone, with many gradations between. Naturally, the character of bone and its histologic picture will be influenced by the age of the tumor, and on first thought it seems that the older the tumor the denser is its bone. While this may apply to certain osteomas of the external canal, it probably does not hold true for all of them. Thus, Hellmann,[1] basing his opinion on 4 personally observed cases, expressed the view that the vast majority of osteomas are originally comprised almost entirely of dense bone but in the course of time, due to a preponderance of bone resorption over bone apposition, they assume more and more the appearance of fibrous tissue tumors.

Of further interest are the observations made by Blake, Burton Alexander (quoted by Vail [5]) and Ostman,[16] who examined the skulls of prehistoric Peruvians and found among them an unusually high percentage of exostoses of the external canal (15 to 25 per cent).

SITE OF PREDILECTION

The small exostoses are usually situated in the bony canal close to the tympanic membrane. The large solitary tumors, however, were found to arise in most instances at the margin of the isthmus of the bony and cartilaginous canal wall, in close proximity to the tympanosquamous suture, and only on rare occasions from other sites in the canal. From their point of origin they grow both outward, toward the external orifice of the canal, and inward, toward the drum membrane. In each of the 2 cases reported by Greene it was observed that the osteoma had constituted the entire posterior canal wall.

PHYSICAL SIGNS AND SYMPTOMS

The large solitary tumor of the external canal is slow growing and usually has existed for years before the patient becomes aware of its presence. It may be accidentally discovered by the patient in the act of cleansing the ear (removal of cerumen), or his attention may be brought to it by a physician. As the tumor increases in size the symptoms of impairment of hearing, tinnitus and pain in the ear set in. There is usually also interference with the egress of cerumen and exfoliated epidermis. In only relatively few of the cases reported was there an associated suppurative process in the middle ear. Eczema and erysipelas of the ear are not infrequent complications. It is of interest that by the time the patient visits an otologist the tumor has almost completely obstructed the external canal, making visualization of the drum membrane virtually impossible. At times even the act of delineating the tumor with a fine probe cannot be carried out. It is difficult to gage the size of the tumor from the appearance of its exposed portion. When

16. Ostman, cited by Bányai and Janota.[3]

the tumor is removed, its size may be found to vary considerably from that which was anticipated. Roentgen examination may be of assistance in determining the size and shape, but the results naturally depend on the character and density of the bony tissue within the tumor. A tumor comprised chiefly of compact bone, as in the case reported by Vail,[5] will throw a dense shadow with a distinct outline. On the other hand, a tumor comprised of spongy bone, as in the cases described by Hellmann [1] or in 2 of the cases herein described by us, will cast no shadow or only a faint shadow with indistinct margins. The hearing impairment, as one would expect, is of the conductive mechanism type.

In spite of their rarity we have had the opportunity to study 3 cases of osteoma of the external auditory canal. Two of the patients came under our care within a period of three months. A report of these cases follows.

REPORT OF CASES

CASE 1.—M. S., a man aged 26, was admitted to the otologic service March 15, 1938 with a history of having sustained an injury to the right ear at the age of 8 years in an automobile accident. At about the age of 14 he noticed some diminution of hearing and also experienced otalgia and discharge from this ear. He was advised to have a "growth of bone" removed. There has been a foul-smelling discharge from the right ear for about eight years, less constantly for the past three years. Frequent episodes of otalgia in the right ear have occurred during the past few months.

Examination.—The left ear was normal. The right ear revealed a large bony growth of the external canal, around which there was a foul-smelling discharge. Tuning fork tests revealed a moderate conductive type of hearing impairment in the right ear. Roentgen examination of the mastoid processes and petrous pyramids showed "dense sclerosis of the entire mastoid process on the right side, but no definite tumor of the external canal could be visualized."

Operation.—A radical mastoidectomy was done by one of us (J. L. M.) with the patient under anesthesia induced with avertin with amylene hydrate and nitrous oxide, oxygen and ether. A postauricular approach was used. The mastoid was sclerotic. The antrum contained a huge foul-smelling cholesteatoma. The "bridge" was removed. A large osteoma completely filling the canal and attached anterosuperiorly was removed in toto by grasping it with a rongeur and by gently rotating it with this instrument. A routine radical operation was then completed.

Biopsy.—Biopsy revealed: (1) osteoma, possibly secondary to chronic suppuration of the middle ear; (2) papilloma of the external canal with chronic inflammatory reaction.

Three weeks after the radical mastoid operation a routine Panse flap was made with the patient under general anesthesia and the postauricular wound was closed. The patient was discharged but was told to return to the clinic for dressings. He failed to do so, and all contact with him was lost.

Summary.—This patient had a large osteoma which completely filled the external canal. There was an associated chronic discharge from the middle ear. The osteoma was attached to the bony canal wall by a wide bony base. At operation a large cholesteatoma was discovered in the antrum and middle ear. A radical mastoidectomy was done and the

osteoma easily removed. The complete postoperative course could not be followed in this case, as the patient disappeared from observation.

CASE 2.—M. A., a man aged 55, was admitted to the otologic service on Aug. 21, 1941, with a history of pain, diminished hearing and noises in the right ear, of seven weeks' duration. He had never had an aural discharge or other symptoms referable to the ears. Examination disclosed the presence of a large hard bony mass occupying almost the entire right external auditory canal. It appeared to be attached to the anterosuperior surface of the canal wall and presented an ulcerated area on its exposed portion. A small amount of thin seropurulent exudate was seen to issue from a narrow slit between the tumor mass and the superoposterior canal wall. In the attempt to outline the tumor it was found impossible to pass a fine probe between the growth and the canal wall. The tumor was not tender and apparently was immobile. The hearing in the right ear was impaired for whispered voice. The left external canal and tympanic membrane were normal, and the hearing in that ear was acute. A diagnosis of osteoma of the bony external canal was made clinically. An audiogram disclosed a typical conductive

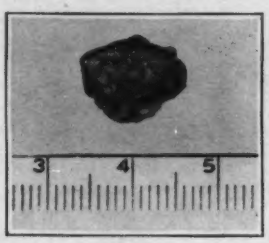

Fig. 1 (case 2).—Gross appearance of tumor. The rule shows metric measurement.

type of hearing impairment, with a loss of 40 decibels for the low tone range in the right ear by air, and relatively normal hearing in the left. On roentgen examination, including a sectional roentgenogram, the right external canal appeared to be of normal size but was obscured by a diffuse dense shadow, which could not be distinctly visualized. The Wassermann reaction of the blood was negative, and results of chemical studies of the blood were normal. Operative removal of the tumor was deemed advisable.

Operation.—With the patient under general anesthesia an attempt was first made to pass a snare around the tumor, but without success. A postauricular incision was then made by one of us (J. G. D.) and the auricle pushed forward. It was observed that the tumor mass was attached firmly to the anterior portion of the bony canal and that it extended posteriorly, occupying a depression in the anterior portion of the mastoid. The act of shaving down part of the cortex of the anterior wall of the mastoid did not afford ample room for the removal of the tumor. The mastoid antrum was therefore opened and the posterior canal wall removed. Only after a modified Panse flap of the membranous canal was made was it disclosed for the first time that the tumor was partially movable, being attached to the canal wall by a broad base of fibrous tissue. This attachment was easily severed by a scalpel and the tumor readily freed. A small amount of exfoliated epidermis was found behind the growth. The tympanic membrane was intact but appeared to be somewhat thickened and lusterless. The external canal was packed firmly with iodoform gauze and the postauricular wound sutured.

The specimen removed was a densely hard oval mass, with a relatively smooth surface, measuring 14 by 10 by 6 mm. (fig. 1). It appeared to be lined by fibrous tissue and skin. A small ulcerated area of the lining membrane was present at one end.

On microscopic examination the tumor was found to be comprised chiefly of fibrous tissue containing lamellated bone with its trabeculae interspersed between the tissue fibers, and also of small areas of fat marrow. On the margins of the bony trabeculae there was evidence of new bone formation of a metaplastic character. Osteoblasts were also seen to line the lacunar spaces; few osteoclasts were present. The tumor was lined partially by stratified squamous epithelium showing a tendency toward invagination and partially by dense fibrous tissue. At one margin of the growth there was a small area of granulation tissue (fig. 2). The diagnosis was ossifying fibroma.

Fig. 2 (case 2).—Histologic section of the tumor, showing a preponderance of fibrous tissue with a relatively small amount of spongy bone. Note the presence of skin lining the tumor at the upper left margin.

The postoperative course was favorable. A second audiogram taken about six weeks after operation showed marked improvement (reduction of only 10 decibels) in hearing.

Comment.—This case presents unusual features from the clinical as well as from the pathologic standpoint. Although the patient had experienced aural symptoms for a period of only seven weeks, there can be no question that the tumor had been present for a number of years. Only after the lumen of the canal had been almost completely obstructed by the tumor did symptoms arise. Furthermore, while some of the smaller tumors reported in the literature could be removed with relative ease through the external canal, in this instance, because of the size of the growth, the posterior bony wall had to be taken down to accomplish this end.

One of the most striking features in this case was the finding at operation of a soft tissue instead of a bony attachment to the tumor, particularly since on previous examination the tumor had appeared to be fixed and immobile. The question arose whether it were not possible that a bony pedicle had existed, which in the course of time, as a result of pressure atrophy or because of lack of blood supply, had broken off and had gradually become absorbed. A subsequent perusal of the literature (only 3 cases of osteoma of the external canal with soft tissue attachment were reported) disclosed the fact that such a view was entertained both by Schumacher [8] and by Szenes [7]; the latter, in describing the tumor reported by him, used the term "osteoma liberum." Drs. Klemperer and Otani, who studied the microscopic sections of the tumor herein presented, arrived independently at the diagnosis of ossifying fibroma. They expressed the belief that originally the tumor had arisen from the periosteum lining the os tympanicum, presenting the usual features of a fibroma, but that it had subsequently undergone ossification, a process not uncommon in tumors at this site. They expressed the belief that a bony pedicle had not preexisted.

CASE 3.—A. T., a man aged 37, was admitted to the otologic service on Nov. 24, 1942 with the following history. He had no symptoms referable to the ears until about one year before, when he began to experience a feeling of fulness in the right ear. Irrigation of the ear by a physician afforded the patient relief from this symptom for several weeks, only to be followed by a return of the complaint with increased intensity. He visited the outpatient department of the Mount Sinai Hospital, where he was told that he had a tumor of the external canal and where a biopsy was made. Subsequently, the tumor was reported to be of a benign character. He was admitted to the hospital for surgical removal of the tumor.

On physical examination a stony-hard mass, partially covered by granulations, was seen to occlude almost entirely the right external auditory canal. A fine probe could not be passed between the free margin of the tumor and the canal wall. The left external canal and middle ear were normal. An audiogram disclosed a loss of about 45 to 50 decibels for all tone ranges by air but normal hearing by bone in the right ear. The hearing in the left ear was normal. Roentgen examination of the right external canal by means of laminagrams failed to disclose any evidence of a tumor. The blood count and the chemical analysis of the blood revealed nothing abnormal, and the Wassermann reaction was negative.

Operation.—With the patient under anesthesia induced with nitrous oxide, oxygen and ether, an endaural incision was made by one of us (J. L. M.). A 1:1,000 solution of epinephrine hydrochloride had been injected into the membranous canal before the incision was made. The mastoid antrum was entered by means of a burr and the mastoid cells exenterated. The posterior bony canal wall was taken down, but the bridge was left intact. A flap was made of the skin of the external canal by severing it above and below. The osteoma was brought into view, and inspection disclosed that it occupied almost the entire lumen of the canal, extending medially to the tympanic membrane. It was attached by a bony pedicle to the anterior-superior portion of the canal. This pedicle was easily severed and the tumor readily removed. The drum was intact but appeared dull. The skin flap was turned down to line the antral cavity and

kept in place by parresine and iodoform packing. The external canal was likewise packed with iodoform gauze. The postoperative course was uneventful. No packing was used after the first full dressing. Seven weeks postoperatively the mastoid cavity was completely epidermized.

Fig. 3 (case 3).—Gross appearance of tumor. The bony pedicle can be seen attached to the upper central part of the tumor. The rule shows metric measurement.

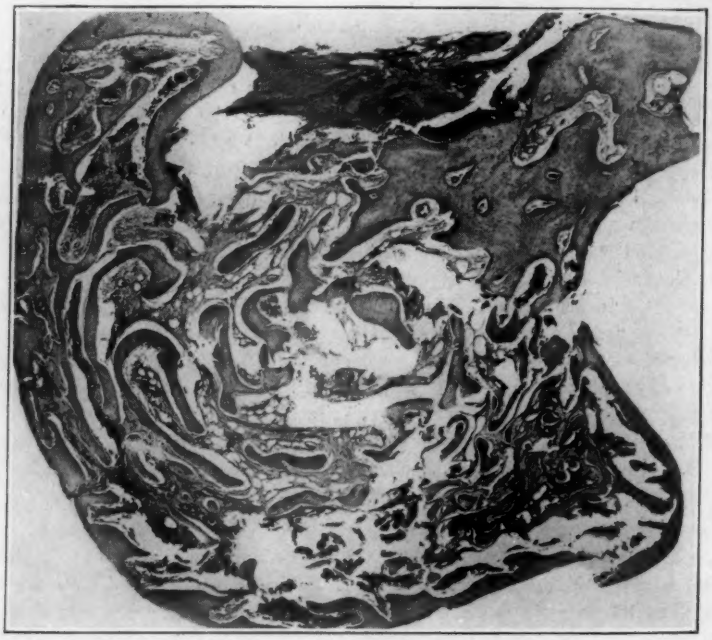

Fig. 4 (case 3).—Histologic appearance of the tumor. The osteoma is comprised chiefly of spongy bone with fibrous marrow tissue. The bony pedicle seen in the upper right part of the field is somewhat denser in character.

The specimen removed is a densely hard tumor mass, somewhat pyramidal in shape, measuring 10 by 7 mm. in its longest diameters. It is lined almost entirely by a soft tissue which appears to be skin. From its surface a narrow bony pedicle protrudes, measuring 5 by 1 mm. (fig. 3).

Histologic sections of the tumor disclose the presence of lamellated bone with haversian systems and perforating vessels. From the main portion of the osseous tissue trabeculae are given off which enclose marrow spaces chiefly of the fibrous tissue type but also of the types containing blood and to a lesser degree fat tissue. The bony trabeculae are lined by osteoblasts. There is little or no evidence of osteoclastic resorption. At one portion the tumor is lined by skin and fibrous tissue. A pedicle of relatively dense bone springs from the surface of the tumor (fig. 4).

Diagnosis.—The diagnosis was osteoma.

Comment.—This case presented many features which resembled those of case 2. In both of these cases the tumor had been present for a long period before the onset of symptoms, and when first seen it occupied the entire external auditory canal. Both tumors were attached to the anterior-superior part of the external canal wall, but instead of the soft tissue attachment present in case 2, the tumor in case 3 had the usual bony pedicle attachment. In both cases, for the satisfactory removal of the tumor it was necessary to exenterate a good part of the posterior canal wall. The approach in the third case was by the endaural route instead of the usual postauricular route.

Histologically the tumor in case 3 differed from that in case 2 in that it consisted of much more osseous tissue, with the usual haversian systems, and of considerably less fibrous tissue. The tumor in case 3 was diagnosed as a typical osteoma, that in case 2 as an ossifying fibroma. After the removal of the tumor in the third case the patient likewise made an uneventful recovery, the wound healing and the hearing improving very satisfactorily.

Indications for and Type of Operative Procedure.—Until recently there has been considerable reluctance in advising surgical treatment for an osteoma of the external auditory canal, despite the fact that such growths frequently are a source of considerable discomfort to the patient. The presence of these osseous growths, even though fairly large, is not sufficient reason for surgical intervention unless annoying symptoms are present or there is danger that the growth may become a menace to the patient.

What are some of the symptoms to which an osteoma in the external auditory canal may give rise and for which surgical treatment may be indicated? Essentially, they are those of a foreign body occluding the canal. Among these symptoms are considerable impairment of hearing, pain, constant sensation of fulness in the ear, tinnitus, occasional vertigo and frequently recurrences of external otitis because of attempts at manipulation on the part of the patient. Associated with suppuration of the middle ear, an osteoma of the canal may give rise to serious consequences. Interference with effective drainage from the middle ear and inability to observe the clinical course of the suppuration may be responsible for a menacing otitic complication.

Reluctance to interfere surgically in these cases has been due in part to the fact that certain untoward results may follow careless or inexpert removal of the growths; among them are injury to the drum membrane and ossicles, with possible infection of the middle ear, injury to the facial nerve and atresia of the canal. If a proper technic is adhered to, none of these should occur.

Whether the postauricular or the endaural approach is decided on, it must be understood that a minimum of trauma is a sine qua non to a successful result. The endaural appears to be the better approach, for the reasons that this incision entails less trauma; it affords a far better view (direct) of the growth, and in the absence of the use of packing after the first dressing subsequent care causes little or no discomfort.

PROCEDURE

The ease with which a tumor can be removed depends on its size, its proximity to the drum membrane and the width of the pedicle. At times it can be removed without difficulty through the external canal, in a manner similar to the procedure used in the case of a nonimpacted foreign body. An attempt may be made to remove the growth by this route, particularly if it is relatively small in size. This approach is usually not successful and therefore should not be persisted in.

The usual endaural incision of Lempert is made, through which a complete simple mastoidectomy is performed. In order to obtain good healing it is advisable to exenterate the cellular structure thoroughly to the inner plate. The question now arises whether to continue the operative exposure and do a modified radical or a radical mastoidectomy. Frequently all that is necessary is to separate the skin from the underlying bony posterior canal and to lower the canal wall without removing the bridge until the growth, if attached by a narrow pedicle, is freed and removed. If the osteoma is attached anterosuperiorly, as in cases 2 and 3, the insertion of the narrow separator between the growth and the lowered posterior bony canal should be made and followed by a gentle rocking movement with this instrument; there results a separation of the tumor, and its removal with a forceps is readily accomplished. The detached skin over the posterior canal is incised above and below and is allowed to fall within the mastoid cavity.

What are the indications for performing a modified radical or a radical mastoidectomy? If the foregoing procedure is unsuccessful on account of the broad base of the growth or in the presence of chronic suppuration of the middle ear, a modified radical or radical mastoidectomy may be necessary, the type of operation depending on the findings on inspection of the drum membrane and the middle ear. The decision

not to invade the middle ear by any further manipulation will be made by the finding of an intact drum membrane or an innocuous middle ear suppuration.

The mastoid cavity is packed with parresine or iodoform gauze, which is removed on the fifth day; no further packing is inserted in the mastoid cavity. Powdered sulfadiazine (2-[paraaminobenzenesulfonamido]-pyrimidine) is sprayed into the wound at each dressing, and if excessive granulations appear, they are either removed with a punch or cauterized with silver nitrate or trichloroacetic acid. Healing promptly follows this procedure and is usually complete in three to six weeks after operation.

The results after operation are most gratifying; the hearing improves appreciably, and the annoying symptoms of which the patient had complained are entirely relieved. Bony growths of the external canal seldom, if ever, recur after thorough removal.

SUMMARY

A review of the literature on osteoma of the external auditory canal is presented. Questions regarding the frequency of occurrence of these tumors, their origin, site of attachment, predisposing factors, microscopic appearance and clinical course are considered. Three cases are reported, with details of the clinical course, operative procedures and histologic findings. The indications for removal of these growths and the various operative procedures are discussed.

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ORBITOETHMOIDAL OSTEOMA WITH INFECTED INTRACRANIAL MUCOCELE

A CEREBRAL ABSCESS OF UNUSUAL ORIGIN

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Following Cushing's [1] thorough review of the problem in 1927, neurosurgeons, oculists and rhinologists alike have recognized the intracranial and orbital complications from osteoma of the nasal sinus. The case presented here is unusual because the accompanying mucocele was infected, presenting the therapeutic problem of an abscess of the brain unsuspected before exposure.

REPORT OF A CASE

L. P., a 24 year old white laborer, was admitted to the Buffalo City Hospital on July 25, 1938, complaining of headache. Two years before, he had sustained a laceration of both supraorbital ridges but recovered completely. In February 1938 frequent attacks of emesis developed, followed by frontal headaches localized on the left. The last attack of emesis occurred on July 4, 1938 and was followed by persistent dull frontal pain localized on the left. During the three weeks prior to admission, he lost 18 pounds (8 Kg.) and was unable to smell. The history otherwise was not significant.

Examination revealed slight tenderness in the left side of the forehead, and the patient complained of a sensation of "denseness" to percussion there. The extraocular muscles and the pupils responded normally to testing. The optic disks were markedly edematous, with hemorrhages and exudates. Slight paresis of the lower part of the right side of the face was present. The other cranial nerves were intact. The abdominal and cremasteric reflexes were present and active. Both knee jerks were sluggish, especially the right, while the ankle jerks were present and equal. Babinski's sign on the right was suggestive. The extremities otherwise were normal to testing. The patient was right handed and displayed no evidence of speech disorder.

A lumbar puncture revealed pressure of 700 mm. of clear colorless fluid, analysis of which revealed nothing abnormal. Roentgen examination of the skull showed a tumor, 3.5 by 2.5 cm. in size, projecting from the region of the left frontal or ethmoid sinus into the floor of the anterior fossa of the skull.

A diagnosis of left ethmoidal osteoma with intracranial mucocele was made.

From the University of Buffalo School of Medicine and the Edward J. Meyer Memorial Hospital.

1. Cushing, H.: Experiences with Orbito-Ethmoidal Osteomas Having Intracranial Complications, Surg., Gynec. & Obst. **44**:721 (June) 1927. Hoover, W. B., and Horrax, G.: Osteoma of the Nasal Accessory Sinuses with the Report of a Case Illustrating the Transcranial Approach to the Orbital Structures, ibid. **61**:821, 1935.

Operation.—On Aug. 1, 1938, with the patient under anesthesia induced with avertin with amylene hydrate (tribromethanol in amylene hydrate), frontal craniotomy was performed on the left side. The lower edge of the bone section was made as near the top of the frontal sinus as possible. The dura was extremely tense but was relaxed somewhat by the intravenous administration of 100 cc. of 50 per cent dextrose solution. The dura then was retracted from the bone, and an osteoma about 1 cm. in diameter and 1 cm. in height was found growing upward into the anterior fossa. The dura was so tightly adherent to the tumor that it could not be separated easily; it was decided to remove the supposed mucocele before attacking the osteoma.

The edematous cortex was exposed through a small dural incision. Exploration with a brain cannula revealed a large, smooth domed cystic mass about 1 cm. below the surface. The dural incision was enlarged, and a 3 cm. disk of cortex was removed from the surface of the lesion. This mass was firm and pinkish gray. A needle was introduced into it, and 10 cc. of creamy yellow pus was aspirated. The exposed bone and the edges of the brain defect were covered with iodoform gauze, and an additional 30 cc. of pus was aspirated. This reduced the intracranial tension considerably. The needle was touched with the electrocoagulating current as it was removed, sealing its tract. The bone flap was discarded, and the wound was closed with fine chromic catgut sutures. The ends of the gauze pack were led through a fresh central incision of the scalp. Bacteriologic study showed the pus to contain Staphylococcus aureus.

The postoperative course was uneventful; a temperature of 101 F. returned to normal on the third postoperative day.

Second Operation.—On August 5, the fourth postoperative day, with the patient under nitrous oxide and oxygen anesthesia, the previously placed iodoform drains were removed, and about 100 cc. of yellow pus welled up from the wound. This appeared to come from an area anterior to the capsule, probably spilling from an opening near its base. The dome of the capsule presented in the wound. It was transfixed on each side with fine chromic catgut sutures, which were tied to the skin edges. The capsule then was opened with the electrosurgical blade and was found to be 3 cm. thick. A large caliber rubber tube with additional side openings was introduced into the capsule to its base, and additional pus was aspirated. Iodoform gauze tapes impregnated with petrolatum were introduced into the capsule and between the capsule and the brain. The capsule was easily separable from the brain and might have been removed had it not been so firmly attached at its base. The tube was stitched to the skin and was cut off flush with it.

After operation the patient showed little systemic reaction. The tension of the area of the craniectomy indicated increased intracranial pressure. This was relieved daily by the cautious withdrawal by lumbar puncture of fluid sufficient to reduce the pressure by one half. The papilledema slowly subsided. The drain tubes were shortened gradually, and finally the wound healed. The decompression still bulged, and it was believed necessary to attack the lesion at its base.

Third Operation.—On September 16, forty-six days after the original operation, the scalp flap was reflected downward, the brain being freed from the scalp at the site of the drainage of the abscess. The dura was separated from the frontal bone when about 20 cc. of pus drained from the subdural space. Subdural exploration then showed the abscess capsule to lead down to the osteoma; the capsule was removed. The dura was elevated from the osteoma. The mass was eburnated and was removed with difficulty with rongeur and chisel. The complete removal of the lesion, by rocking it from its bed, was not done because of the presence of infection, which precluded the use of a fascial graft, which is necessary to separate the

nasal cavity from the dura. The cavity resulting from the removal of the abscess was lined with iodoform gauze impregnated with petrolatum and rubber tissue drains were inserted. Another rubber tissue drain was led from the gutter between the scalp and the edge of the bone defect. The drains all were brought out of the central scalp wound.

Histologic examination of the abscess capsule revealed columnar mucous epithelium in some areas.

After operation, drainage from the wound was profuse and again increased intracranial pressure was controlled by frequent lumbar puncture. The drains were removed gradually, and although drainage persisted, the tension of the flap subsided, and the area of the craniectomy became depressed. The patient was discharged from the hospital to the outpatient department on November 8. The discharge gradually cleared up. The advisability of removing the remaining portion of the osteoma through the frontal sinus was considered, but rhinolaryngologists as consultants advised against it.

On Sept. 6, 1940 the unsightly depressed cranial defect was repaired by Drs. William F. Beswick and John Burke with an osteoperiosteal graft taken from the tibia. The wound healed promptly, with a good cosmetic result.

On September 25 the patient was readmitted to the hospital because of jacksonian convulsive seizures starting in the right side of the body and occurring every thirty minutes until they were controlled by rectal administration of avertin with amylene hydrate. On the following day an encephalographic examination disclosed mild dilatation of the frontal horn of the left lateral ventricle and a suggestion of a porencephalic cyst under the bone defect. Stereoroentgenograms showed new bone formation near the bone graft. The patient recovered and was discharged on October 11, having no further complaints.

COMMENT

Although osteoma arises primarily from the nasal accessory sinuses and usually from the ethmoid labyrinth, it rarely gives rise to any disturbance of the air passages. It may extend laterally into the orbit to displace the globe, producing exophthalmos.[1] As it extends upward through the floor of the anterior cranial fossa, several intracranial complications become possible. Violent blowing of the nose may force a passage through the thin sinus membrane beside the base of the lesion. Through this narrow channel air may be forced into the epidural or the subdural spaces or even into the brain to produce intracranial pneumatoceles. Kessel[2] collected from the literature 15 cases with pneumatocele. These collections of air may rupture into the lateral ventricle or into the subarachnoid space so that cerebrospinal rhinorrhea develops. On other occasions, extensions of the sinus mucosa may accompany the osteoma as it pierces the dura. As secretions accumulate, an intracranial or intracerebral mucocele develops. The latter may become sufficiently large to act as a space-filling intracranial lesion. If the significance of the osteoma, disclosed by roentgenogram, is not appreciated, a neoplasm may be suspected. From the standpoint of therapy this matters little

2. Kessel, F. K.: Orbito-Ethmoidal Osteomas with Intracranial Complications: Report of a Case, Guy's Hosp. Rep. **89**:337, 1939.

if the lesion is corrected when disclosed. The case presented here, however, indicates that so innocuous a lesion is not always to be expected. In none of Kessel's [2] 15 cases was such a complication present, and in an incomplete review of the literature I did not find another similar case. If craniotomy is done primarily, the patient is subjected to the loss of the bone flap, which cannot be replaced in face of the infection, and to the later necessity of cranioplasty. In future attacks on suspected intracerebral mucoceles, I shall aspirate the lesion through a trephine opening before doing craniotomy. If the lesion is found infected, it can be treated as an abscess primarily, and later the osteoma and capsule can be removed.

SUMMARY

A case is presented of an osteoma of an ethmoid with symptoms suggesting an accompanying intracranial mucocele. At craniotomy the mucocele was found to be infected, necessitating the performance of several procedures for its eradication. It is suggested that correction of the lesion may be easier if diagnostic aspiration of the suspected mucocele is done through a simple trephine opening before craniotomy is performed.

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INFECTIONS WITH ANAEROBIC STREPTOCOCCI

WITH SPECIAL REFERENCE TO CRANIAL OSTEOMYELITIS

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This paper is presented in the belief that infections about the head by anaerobic and microaerophilic streptococci are more important than is generally appreciated. Also, the behavior of these organisms may explain some of the doubtful factors in the pathogenesis of infection of cranial bones. If these anaerobes are responsible for such infections, it is likely that their control will be considerably helped by measures shown effective against such anaerobes elsewhere, particularly by the use of zinc peroxide. Conversely, the observation that zinc peroxide seems to be effective in the control of infection of the cranial bones in at least some cases should help strengthen the case against anaerobes.

My earlier experience with frontal osteomyelitis seemed to fit into the conventional conception, with average success with radical surgical therapy. Four consecutive patients given such treatment in 1932 recovered and made the current ideas on pathology and management seem satisfactory.

Then followed several clinical disasters in cases of infections of the sinuses and cranium due to anaerobic or microaerophilic streptococci which focused my attention on the work of Meleney and Johnson.[1] Later the excellent response to the treatment of other similar infections according with their methods made me feel that their ideas of such infections in soft tissues could be applied to infections involving the cranial bones.

Meleney and Johnson saw some 40 patients with chronic undermining ulcers in the soft tissues; a wide variety of treatment had been tried without success. The causative organisms were anaerobic or microaerophilic streptococci, and nearly all of these previously resistant infections were cured by free dissection and contact with zinc peroxide. This agent gives up its oxygen slowly enough so that the wound may

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1. Meleney, F. L., and Johnson, B.: The Prophylactic and Active Treatment of Surgical Infections with Zinc Peroxide, Surg., Gynec. & Obst. **64**:387 (Feb.) 1937.

have a constant contact with nascent oxygen. The technic will be described in another section of this paper.

In most discussions of cranial osteomyelitis emphasis has been placed on anatomic factors. Furstenberg,[2] Mosher and Judd [3] and others have shown the importance of thrombophlebitic processes in the diploic venous spaces and dural veins in the spread of osteomyelitis of the cranial bones. These observations have been largely accepted as the explanation of this spread.

Such explanation has not seemed entirely satisfactory in relation to two factors. First, it does not quite make understandable why involvement of the maxilla and other compact bones may lead to such serious consequences. Furstenberg has stated that the involvement of the haversian system explains osteitis of the anterior and posterior walls of the frontal sinus, and Mosher and Judd have accepted that explanation for the involvement of other compact bone, but it would not seem that thin bone in contact with vascular periosteum and mucoperiosteum should easily undergo necrosis if the process came through vessels within the bone. Such necrosis could, however, easily occur with anaerobic infection burrowing along the periosteum, as Meleney has shown it travels along fascial planes in soft tissues. In at least 2 of my cases involvement seemed definitely primarily along the periosteum. Secondly, these fulminating infections, as pointed out by McKenzie [4] years ago, are more likely to follow minor interventions than extensive surgical methods, in which there is usually greater opportunity for contamination. Such minor procedures could easily produce enough injury to reduce the blood supply and yet furnish a covered focus in which anaerobic organisms may thrive.

When my experience had convinced me that the factor of anaerobic infection provided an acceptable explanation for the unusual aspects of involvement of cranial bones, I again reviewed the literature and found that I had not been properly impressed by the important work of Williams and Heilman [5] and Pastore and Williams.[6] These authors

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2. Furstenberg, A. C.: Osteomyelitis of the Skull: The Osteogenetic Processes in the Repair of Cranial Defects, Ann. Otol., Rhin. & Laryng. **40:** 996 (Dec.) 1931.

3. Mosher, H. P., and Judd, D. J.: An Analysis of Seven Cases of Osteomyelitis of the Frontal Bone Complicating Frontal Sinusitis, Laryngoscope **43:** 153 (March) 1933.

4. McKenzie, D.: Further Observations on Spreading Osteomyelitis of the Skull, J. Laryng. & Otol. **42:**293 (May) 1927.

5. Williams, H. L., and Heilman, F. R.: Spreading Osteomyelitis of the Frontal Bone Secondary to Disease of the Frontal Sinus, with Preliminary Report as to Bacteriology and Specific Treatment, Arch. Otolaryng. **25:**196 (Feb.) 1937.

(Footnotes continued on next page)

concluded that spreading osteomyelitis of the cranial bones was usually due to anaerobic hemolytic streptococci. They followed the suggestion of Watkyn-Thomas and McKenzie [7] that material for culture be taken from the interior of the sequestrum and were able to demonstrate anaerobic hemolytic streptococci in 4 consecutive patients with frontal osteomyelitis. All recovered under treatment with antivirus irrigations.

It will take many reports to establish the relative frequency of anaerobic infections in cases of cranial osteomyelitis, but it is my belief that it will be high. Since I have been looking for anaerobes in cases of this kind I have failed to find them in very few instances, although it frequently required insistence on special care in cultures, repeated cultures or taking of material for culture from the advanced border of involvement. Meleney's statement that "the essential organism [in anaerobic infections] is missed because in the great majority of hospitals bacterial studies are limited to simple aerobic culture on routine media" seems quite true.

In assessing the relative frequency of these organisms one must consider the difficulty of getting material from the area of primary invasion and isolating the primary organism without overgrowth by secondary invaders. In 1 case in the early stages culture of material from the antrum yielded anaerobic streptococci, but eleven other cultures of material from the osteomyelitic foci revealed only staphylococci. However, culture of material from the subdural terminal space brought out the same type of anaerobic streptococci. The laboratory work in this case was above average.

It is difficult to determine the influence of secondary invaders, although they may be important in causing a rapid advance in what had been a slow preliminary process. It is difficult to ascertain the important organism in a multiple infection. The clinical behavior and the response to treatment permit some conclusions, as will be brought out in discussing individual cases.

Sabouraud's observation [8] is interesting, although it was given in discussing pyodermas. He said: "In a polymicrobic lesion with staphylococci and streptococci one can know in advance that the streptococcus begins it. Streptococci are never secondary to any other invader, while staphylococci can be secondary in all."

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6. Pastore, P. N., and Williams, H. L.: Osteomyelitis of Frontal Bone Secondary to Suppurative Disease in Frontal Sinus: Report of Case, Proc. Staff Meet., Mayo Clin. **13**:7 (Jan. 5) 1938.

7. Watkyn-Thomas, F. W., and McKenzie, D.: The Bacteriology of Spreading Osteomyelitis of the Skull, J. Laryng. & Otol. **44**:253 (April) 1929.

8. Sabouraud, R.: Pyodermites et eczémas, Paris, Masson & Cie, 1928, p. 135; cited by Mitchell, J. H.: Streptococcic Infection Simulating Ringworm of Hands and Feet, J. A. M. A. **104**:1220 (April 6) 1935.

According to Meleney,[9] there are three main groups of anaerobic streptococci found in the human body. 1. The most important are the slightly hemolytic, microaerophilic streptococci found especially in ulcerative nongangrenous lesions occurring near body surfaces and undermining soft tissues. They occur in fine chains and grow under reduced oxygen tension but are not absolute anaerobes and apparently can adapt themselves to their environment to some extent. This type of organism was the one probably present in most of my cases but was not usually so identified because the bacteriologist was not following Meleney's classification. This type responds especially well to zinc peroxide treatment. 2. Strictly anaerobic, nonhemolytic streptococci are less common and occur in and around the teeth and tonsils, in putrefactive processes in the intestinal tract and in foul pulmonary abscesses. They are generally of low virulence and may not be capable of producing disease except in symbiosis with other organisms or where there has been necrosis from trauma or loss of blood supply. 3. Nonhemolytic, microaerophilic streptococci are found in very chronic gangrenous lesions of the chest or abdominal wall, usually in symbiosis with staphylococci. Their lesions are indurated and painful with a gangrenous border, and the protected organisms are not so vulnerable to oxidation treatment.

These anaerobic organisms are not rare. Pulaski, Meleney and Spaeth [10] were able to recover anaerobic streptococci from 21.6 per cent of clean wounds and from 43.8 per cent of dirty wounds. Incidentally, these authors stated that staphylococci can be cultivated from nearly every wound and from the unbroken skin. Meleney suggested that such organisms have adapted themselves to an environment of lowered oxygen tension by growing in the intestinal tract, the vagina or the lymph nodes. Perhaps undermined mouth tissues or blocked sinuses could provide such a habitat.

The manner in which anaerobes may gain a foothold in bone is suggested by experiments by Canavero and Maggi.[11] By injecting the bacillus of malignant edema intravenously they produced infection of bone by this organism only if the bone or periosteum was traumatized or if staphylococci were injected at the same time. In the problem of the sinuses and cranial bones, operation or other trauma can furnish the factor of injury and the ever present staphylococci can supply another sensitizing factor.

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9. Meleney, F. L., in Christopher, F.: Textbook of Surgery, ed. 3, Philadelphia, W. B. Saunders Company, 1942.

10. Pulaski, E. J.; Meleney, F. L., and Spaeth, W. L. C.: Bacterial Flora of Acute Traumatic Wounds, Surg., Gynec. & Obst. **72**:982 (June) 1941.

11. Canavero, E., and Maggi, E.: Osteomieliti da ger mi anaerobi patogeni (Ricerche sperimentali), Policlinico (sez. chir.) **48**:1 (Jan.) 1941.

If these organisms grow well only under conditions of lowered oxygen tension, it follows that their growth will be prevented by methods which raise the oxygen tension. It is obvious that this condition would be provided to some extent by wide exposure and débridement, as is the current practice in successful treatment of cranial osteomyelitis. That would also occur probably with Williams' treatment with antivirus, even aside from a question of its specific effect. Urea also may be effective by its removal of necrotic material, and I have found it of some value in infection due to anaerobic streptococci but decidedly less efficient than zinc peroxide when substituted for the latter. Hagens [12] has recently used it successfully in treating a spreading infection of the mastoid due to anaerobic streptococci which resisted other measures.

The most logical means of combating these anaerobes, however, appears to be Meleney's technic of using zinc peroxide. He treated with almost uniform success a series of burrowing ulcers due to microaerophilic organisms which no other methods had been able to combat. In the patients I have treated with his technic the results have appeared strikingly favorable.

Meleney insists on three main points of treatment: 1. The drug used has varied somewhat chemically and in its action in spite of great care in preparation. The product made by E. I. du Pont de Nemours & Co., Inc., has proved satisfactory. This must be sterilized and activated in small lots (15 to 25 Gm.) by heating for four hours in an oven at 140 F. with no more than 10 degrees variation. Just before being used this activated chemical is made into a 40 per cent cream with sterile distilled water. 2. The chemical must be brought into exact contact with the organisms wherever they lie. This may necessitate extensive dissection with wide undermining of any area possibly infected. The zinc peroxide may best be brought into direct contact by packing gauze saturated with zinc peroxide paste into all surfaces of the wound. 3. The wound must be sealed against evaporation with gauze on which petrolatum or zinc oxide has been applied, as moisture is necessary. The zinc peroxide gives up oxygen slowly and this combines with the water present to form hydrogen peroxide, which in turn bathes the wound, giving up its oxygen.

I have used tubes with fair success where pockets held the cream in contact, but saturated gauze packs seem definitely better. If gauze packs well sealed with petrolatum gauze are used, only daily dressings are necessary. When tubes are used, zinc peroxide cream is forced in twice daily or oftener.

12. Hagens, E.: Personal communication to the author.

A synopsis of cases of infection involving the cranial bones due to anaerobic streptococci is given in the accompanying table. More detail is presented in the discussion of individual cases. My first use of zinc peroxide was especially gratifying because it followed a previous tragic case in which the disease had begun in exactly the same way and in which I was powerless to stop the inexorable march of the disease.

Summary of Cases of Anaerobic Streptococcic Infections of Cranial Bones

Case	Followed	Duration	Outcome	Lesions	Culture	Treatment
1 11/9/37	Antrum window, 10 days	4 mo.	Death	Osteomyelitis of maxilla, frontal, parietal; meningitis; subdural abscess	Anaerobic green-producing streptococci at onset and end; 11 other cultures, only Staph.	Chemotherapy ineffective; radical operations; transfusions
2 11/11/39	Swimming, 6 days	56 days	Death	Osteomyelitis of sphenoid sinus; abscesses of septum, pharynx, Tenon's space, brain	Anaerobic hemolytic streptococci throughout	Drainage of abscesses
3 6/14/40	Acute "cold"	1 week	Death	Osteomyelitis of frontal sinus, pansinusitis	Anaerobic hemolytic streptococci and Staph. aureus	Chemotherapy
4 1/16/40	Antrum window, 10 days	1 mo.	Recovery	Periosteitis (?); cellulitis	Anaerobic hemolytic streptococci	Chemotherapy ineffective; elevation of periosteum; zinc peroxide
5 2/4/40	Acute maxillary frontal sinusitis	1½ mo.	Recovery	Osteomyelitis of maxilla, frontal and ethmoid sinuses	Anaerobic hemolytic streptococci	Wide opening; zinc peroxide
6 2/4/42	Displacement irrigation (?)	1½ mo.	Apparent recovery; then meningitis and death	Osteomyelitis of frontal and parietal sinuses; subdural abscess	Anaerobic hemolytic streptococci and Staph. aureus	Sulfathiazole no effect; radical operation; zinc peroxide
7 11/1/41	Removal of cyst	6 weeks	Recovery	Abscess of canine fossa	Microaerophilic hemolytic streptococci and Staph. aureus	Drainage; zinc peroxide
8 3/12/42	Antrum puncture (?)	3 mo.	(?)	Osteomyelitis of maxilla, nasal and lacrimal bones	Microaerophilic hemolytic streptococci and Staph. aureus	Removal of necrotic bone; zinc peroxide
9 1/26/42	Dental extraction	5 mo.	Arrest (?)	Diffuse osteomyelitis of mandible	Anaerobic hemolytic streptococci; other cultures, aerobic hemolytic or green-producing streptococci	Pack; curettement; finally zinc peroxide

REPORT OF CASES

CASE 4.—E. H., 23 year old son of a dental pathologist, had had a subacute right maxillary sinusitis which did not improve on treatment, including lavage. After one month a simple antrum window was made under the intact infracted inferior turbinate, only a perforator, cutting and Kerrison forceps being used. Procaine hydrochloride was injected into the root of and under the inferior turbinate. The patient left the hospital the next day with little reaction.

One week later he had severe pains in the right cheek with moderate swelling, progressing to involve the lower lid and the right side of the nasal

bridge. Heat and full doses of sulfapyridine (2-[paraaminobenzenesulfonamido]-pyridine) had apparently no effect. When cultures were reported to yield a slightly hemolytic anaerobic streptococcus, another tragedy was foreseen.

Ten days later an oblique incision 2 cm. long was made in the cheek, and a 0.5 cm. button of bone was removed from the anterior maxillary face with no opening through the mucosa. No pus was found here, but the soft tissues were red, thick and edematous. The periosteum was elevated to the orbital margin and the lacrimal fossa and over the right nasal bone. Intranasally an opening was made over the root of the turbinate, where some thick, foul, yellowish pus was found. Small tubes were left in, and zinc peroxide paste was forced in twice daily to the limits of undermining and sealed as well as possible with petrolatum gauze. Ten days later a pocket of pus was evacuated from the right orbital margin.

With this exception there was no further spread of infection after the use of zinc peroxide was begun, and the immediate improvement locally and generally was striking. Five months later a small sequestrum was removed from the wound in the cheek, and the patient has been in excellent health since. It is of course possible that the same result might have followed simple drainage, but my experience with similar cases makes me doubt this.

CASE 5.—R. M., a 23 year old man, on Feb. 4, 1940 had an acute left frontal and maxillary sinusitis, treated elsewhere, it was stated, by conservative measures. Thirteen days later there was severe pain in the teeth and brow, followed in three days by severe edema of the eyelids, violaceous swelling of the adjacent skin and extreme tenderness. The pupil was dilated and nonreactive and the eye proptosed. The patient was treated with sulfapyridine, heat and nasal packs with suction, but his condition grew progressively worse in five more days. Then anaerobic hemolytic streptococci were reported in culture. A roentgenogram showed extensive clouding of the left frontal and maxillary sinuses.

At operation, on March 23, by the external route, pus was found under the periosteum above the internal canthus; the lamina papyracea was necrotic, as were the anterior and posterior ethmoid cells, which were filled with broken-down debris and foul pus. Part of the ascending process, the left nasal bone and the frontal floor were removed. A window was made into the antrum through the inferior meatus. Three tube drains were left in, and zinc peroxide paste was injected twice daily at first and later once daily for about one month. One hundred per cent oxygen inhalations were given for a few days, probably without effect.

After the operation there was no apparent spread of the infection. General improvement was gradual, with slowly diminishing drainage. Two months later a loose sequestrum 2.5 cm. wide was removed from the floor of the frontal sinus and also one 1.5 cm. wide, apparently part of the dural plate; another, from the nasoantral wall, was removed by the Caldwell-Luc operation on the antrum. The wounds then closed, and there has been no further trouble for over eighteen months except that the left eye is blind and diverges.

CASE 6.—H. E. C., a 28 year old Negro, was seen as an outpatient on Dec. 11, 1941, complaining of a headache of six weeks' duration. A diagnosis of subacute frontal and maxillary sinusitis was made. Two displacement irrigations were done. Two days later there was a swelling over the center of the forehead, which spread rapidly to the right brow and orbit. On December 19

a puffy, fluctuant mass was present over the right eye. On the diagnosis of perforating sinusitis the right frontal sinus was drained, a tube left in place and the subperiosteal abscess drained.

Because of a recent highly favorable report of the efficacy of sulfathiazole (2-[paraaminobenzenesulfonamido]-thiazole) in osteomyelitis,[13] the patient was treated with full doses of that drug, without effect except for loss of valuable time. Nine days later the temperature was 101 F., the discharge had increased and painful edema had spread over the entire forehead.

On Jan. 1, 1942 a wide resection of the frontal bone was done under a crescentic flap hinged below. Typical osteomyelitic, yellow-red, necrotic bone was found, and much thick exudate lay on the dura. Bone was removed 2 cm. beyond any apparent involvement of bone and dura, and both plates were removed from the upper borders of both frontal sinuses.

One week later there was considerable secretion from the lower outer angles of the wound; so all bone down to a narrow orbital ridge was removed, and rubber drains were placed externally through the floors of both frontal sinuses.

Cultures previously had been reported to yield hemolytic streptococci and Staphylococcus aureus. With insistence on special care in culturing, anaerobic hemolytic streptococci were then found by both the hospital and a private laboratory. The wound was left wide open, packed with gauze saturated with zinc peroxide cream and well covered with petrolatum on gauze, although there was thirty-six hours' delay in securing the chemical.

General improvement was good, and the change in the local wound was rather amazing, with cessation of secretion and fast growth of healthy granulation tissue. The flap was rapidly retracting, and the general condition was apparently normal; so the mistake was made of closing the wound thirty-five days after the last operation, a counterincision 3 cm. above being used to relieve tension. For two weeks the patient did well, with the wound apparently nearly healed. With little warning, symptoms of intracranial involvement developed, and at operation there was found under the dura much flocculent foul exudate with extensive thrombosis of the pial vessels, apparently coming from a focus 2 inches (5 cm.) from the healthy bone border. There was also some reinfection under the flap. The patient died four days later.

This patient probably should have been saved. Where adequate contact with zinc peroxide was made, the result was unusually good, and the rapid improvement of the wound was convincing of efficacy of the treatment, especially in comparison with similar wounds previously seen. Intervention should have been earlier and more radical, and closure should have been delayed or the raw surface covered with Thiersch grafts. It is hard to determine the completeness of the cure of anaerobic infection by culture, because of the uncertainty of securing material from contaminated pockets and also the difficulty of growing the organisms. No wound from which anaerobic streptococci can be obtained by culture should be closed. Early confidence was falsely placed in chemotherapy alone. This accords with the experi-

13. Hoyt, W. A.; Davis, A. E., and Van Buren, G.: Acute Hematogenous Staphylococcic Osteomyelitis: Treatment with Sulfathiazole Without Operation, J. A. M. A. **117**:2043 (Dec. 13) 1941.

mental demonstration of Fox[14] that sulfanilamide is ineffective under lowered oxygen potentials and accords with Meleney's clinical observation to the same effect. The latter, however, found the result was improved when the organisms were in contact with zinc peroxide.

CASE 7.—J. L., a 45 year old white man, for years had a recurring fluctuant swelling over the left canine fossa. A cyst, 4 by 3 cm., lined with respiratory epithelium was removed by sublabial incision from a bed involving the bone of the nose and the anterior maxillary face up to the lacrimal fossa. It broke as the last few millimeters of its upper attachment was freed, and this area was desiccated by diathermy. Preliminary healing was good, but drainage persisted and finally became profuse for one month in spite of injections of sodium sulfathiazole. Finally an anaerobic, slightly hemolytic streptococcus was isolated in culture. With daily instillation of zinc peroxide through the sublabial incision, the discharge rapidly lessened, and the wound completely healed in ten days.

The courses of the infections in the cases reported, even in the fatal one, seemed convincing proof of the efficacy of zinc peroxide, especially in the light of the following case of infection due to anaerobic streptococci, which was observed before zinc peroxide was used.

CASE 1.—I. K., a 17 year old white girl, seen with Dr. L. F. McBride on Nov. 9, 1937, had a condition which began almost exactly like that in case 4. Ten days after an antrum window was made, swelling developed around the orbit and side of the nose. An abscess of the septum and one over the lacrimal fossa were drained through the frontal bone. From then on, in spite of three operations with very radical and apparently complete removal well beyond any involvement of frontal and parietal bone, the patient progressively lost ground and died in four months of poorly localized intracranial suppuration.

An anaerobic hemolytic streptococcus was isolated from the antrum at the first flare-up and a similar organism from the exudate covering the brain terminally. Eleven cultures over the intervening months in a good hospital laboratory were reported to yield only Staph. aureus. Only after the findings were reviewed in the light of later experience was true importance assigned to the anaerobic organism. Full doses of sulfapyridine, many transfusions and repeated radical operations well beyond the zone of apparent involvement seemed in this case to do little to halt the inexorable march of the disease.

The result in this case was in sharp contrast with that in case 4, in which a similar process was at once controlled by zinc peroxide.

CASE 2.—L. S., a 13 year old white girl, seen with Dr. R. H. Henderson, six days after swimming in a pool had a stiff, painful neck, was listless and had a temperature of 105 F. Before death, sixty-four days later, she had progressively, with brief periods of remission, a septal abscess, bilateral retropharyngeal abscesses, an abscess in Tenon's space of the right eye, not involving orbital fat or periorbita, and an abscess in the brain. The last was not found at operation by a neurosurgeon because it lay so deeply. All of the other abscesses

14. Fox, C. L., Jr.: The Significance of the Oxidation of Sulfanilamide During Therapy, Am. J. M. Sc. **199**:487 (April) 1940.

were drained as they developed, and transantral drainage of the orbit and ethmoid and sphenoid sinuses was done, without stopping the progress of the disease. As expected, at autopsy these processes were found to have radiated from an osteomyelitis of the sphenoid bone. Repeated transfusions and full chemotherapy were used. Cultures of material from all abscesses, including the brain at autopsy, disclosed a fine-chained anaerobic streptococcus, moderately hemolytic. Although there was osseous involvement, the radiating extension was not through bone but along the perichondrium, periosteum and fascia and possibly by lymphatics into Tenon's space.

The organism in this case was probably not very virulent, as the various abscesses healed after adequate drainage and in the interim the general condition was fair, leading to the hope in each instance that the end of the disease was in sight. The value of zinc peroxide was not appreciated at that time, but it now seems possible that it could have been introduced to the seat of the disease by tubes through the transantral route with good effect.

CASE 3.—A. N., a 7 year old white girl, was admitted to St. Francis Hospital on July 14, 1940, with a history of a cold for six days followed by a sharp rise in temperature. There was a superficial swelling, not doughy, over the root of the nose, with considerable nasal discharge, and there were nausea and vomiting. A roentgenogram showed cloudiness of all sinuses. Four consultants, including myself, advised expectant treatment at this time. The next day spasticity, a doubtful Kernig's sign and severe sepsis were present, followed in four days by definite meningeal symptoms. Two days later the patient died as the neurosurgeon prepared to operate.

At autopsy a subdural abscess of the right frontoparietal region, acute leptomeningitis and pansinusitis with early frontal osteomyelitis were found. Cultures of nasal material on admission had been reported as showing staphylococci. Culture on the fifth hospital day was reported as showing Staph. aureus and hemolytic anaerobic streptococci. From the pus of the subdural abscess obtained at autopsy was isolated a similar fine short-chained hemolytic streptococcus which grew only anaerobically. Sulfapyridine up to 2 grains per pound of body weight (0.29 Gm. per kilogram) per day, without effect, and general supportive treatment, including intravenous administration of fluids, were given.

Probably no treatment would have availed in this case, although it suggests again the serious results that may follow in the presence of this type of organism.

CASE 9.—E. J., a 21 year old white woman, one year after removal of impacted molars had had recurring episodes of acute pain and swelling with fever. A roentgenogram showed a diffuse destructive process with areas of decreased density up to 1 cm. in width. Dental extractions and opening of local abscesses had not arrested the process, which continued to advance slowly. Anaerobic hemolytic streptococci predominated in a culture on Nov. 5, 1941, although after that aerobic green-producing and hemolytic streptococci only were found. Full doses of chemotherapy had little effect. Pain around the lesions was intense. On Jan. 26, 1942 I advised débridement with elevation of the periosteum over the affected area and zinc peroxide packs, but this was

considered too drastic and I did not see the patient again. About one month later, I was informed, this treatment was followed, and the patient has shown marked improvement since.

COMMENT

In this series there have been at least four definite types of involvement by anaerobes: 1. An uncontaminated anaerobic infection in which, although the primary focus was osteomyelitis, the spread was in soft tissues, chiefly along fascial planes. In case 2 the primary focus was apparently an osteomyelitis of the sphenoid bone, from which secondary infection burrowed or was carried by lymphatic spread to form septal, lateral pharyngeal abscesses, suppuration in Tenon's space and an abscess in the brain. Some authors believe Tenon's space is a potential lymph space, and this involvement is most easily explained as carried through lymphatics.

2. A necrotizing process involving the soft tissues with secondary "bone death" without the usual picture of osteomyelitis and sequestration. In case 8 the soft tissues on both sides of the nasoantral wall were missing or necrotic, the bone was ivory hard and even after three months there was no line of sequestration. It may be that there was very early loss of blood supply and not enough circulation for cellular reaction with activity of osteoclasts and osteoblasts.

3. A slow development from the compact bones with relatively rapid extension and a fulminating process after the frontal area is reached. It may be that the secondary invader, most likely a staphylococcus, can spread more rapidly according to the conventional pattern by thrombophlebitis when the venous spaces and diploic bone are reached. It may still be true here that it is the anaerobes which are the advance guard, as described by Williams.

4. A process involving primarily the frontal bone, as described by Mosher and Furstenberg, and carried along veins and blood spaces.

The first two types and probably the third are primarily due to anaerobes. The evidence is less certain in the fourth group, and I think it will take considerably more statistical evidence to settle the question. I feel that here too the anaerobes are more likely to prove to be the primary invaders.

Some symptoms in this series seemed almost pathognomonic of anaerobic infection. These were severe pain, excruciating tenderness, foul odor of the secretion or necrotic tissue and pronounced induration where fluctuation was not present. Persistence of infection over long periods was characteristic except when there was a fulminating termination or an arrest by treatment. This would be expected with organisms like the anaerobes, whose low metabolism permits a sort of hibernating existence.

Aside from the cases mentioned, zinc peroxide has proved effective in other instances of infection due to anaerobic streptococci. A putrid maxillary sinusitis associated with microaerophilic hemolytic streptococci, irrigated through the natural opening with zinc peroxide cream left in, lost its odor with reduction in the amount of secretion. The cavity left after removal of a submaxillary gland containing stones and an abscess yielding microaerophilic streptococci showed little improvement until zinc peroxide cream was instilled daily, when it healed quickly. A patient with empyema due to an anaerobic streptococcus which followed removal of a walnut kernel which had been in the bronchus for five weeks had each pocket heal quickly when it was packed with zinc peroxide gauze, although new pockets continued to form for some time. An infection of the mastoid due to Bacillus pyocyaneus did not respond to zinc peroxide treatment, although this is a microaerophilic organism. Meleney also found this organism resistant. An actinomycosis of the cheek was scarcely affected by zinc peroxide injected into the fistula, as might be expected, since the organism is protected by areas of fibrosis, although the organism is anaerobic.

In anaerobic infections in soft tissues anatomic factors have also been emphasized more than the type of invading organism. In Ludwig's angina the fascial limitations have been considered most important, yet it has seemed to me probable that anaerobes from the mouth determined to a greater extent the nature of the process. The anatomic factor, of course, is important, because in the region of the floor of the mouth, edema and inflammatory swelling of the primary invasion shut off circulation and provide the anaerobic conditions optimal for the spread of these particular organisms. Also, the cure is brought about by wide incision which provides not especially good drainage for a relatively unlocalized infection but rather releases tension, restores circulation and allows access of air to the infected territory.

CONCLUSIONS

1. Anaerobic or microaerophilic streptococci can be found by proper technic in many, if not most, cases of cranial osteomyelitis.

2. Their presence explains factors in the spread of such lesions not previously understood.

3. Such infections can be better controlled by wide exposure and the exact application of oxidizing agents, especially zinc peroxide.

4. Such organisms are probably important in other infections about the head and neck.

636 Church Street.

CORRELATION OF HEARING ACUITY FOR SPEECH WITH DISCRETE FREQUENCY AUDIOGRAMS

METHOD OF DETERMINATION

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Since the discovery of the thermionic tube and its eventual association with electrical circuits designed to produce measured frequency cycles, audiometry, or the method of measuring the acuity of human hearing, has become an exact science. Previously, sound sources for this important determination consisted primarily of tuning forks and the whispered and spoken voice, calibrated with some accuracy in terms of duration but quite inaccurately in terms of measured loudness. The development of audiometry, which Bunch [1] described so completely, represents primarily a reaction to the obvious inadequacies of the earlier methods of testing hearing. The introduction of the vacuum tube audiometer, with its specific frequency and volume ranges, marked a new era in scientific methods for the appraisal of hearing loss.

Audiometry today is an accepted otologic technic. It measures specifically and accurately impairment of hearing against an established normal level for both air and bone conduction. Its scope is rapidly expanding. No longer is the simple establishment of "degree" of deafness adequate. Special technics have contributed qualitative and quantitative information essential for diagnosis of any type of hearing loss. However, the discrete frequency audiogram is now generally accepted as the measure of hearing acuity. It measures the improvement resulting from any type of therapy. It is the basis for the much discussed percentage loss of hearing.

Essentially, the audiogram represents the threshold of hearing for a series of frequencies arranged in octave steps from 128 to 8192 cycles, which are the important tone levels of human acoustic experience. Frequencies above or below these extremes so far as human hearing is concerned are analogous to infra-red and ultraviolet radiation in the visual field.

From the Otological Research Laboratory, Abington Memorial Hospital.

1. Bunch, C. C.: The Development of the Audiometer, Laryngoscope **52**: 1100-1118 (Dec.) 1941.

After decades of satisfaction with the earlier methods it is interesting to note that in less than twenty-five years criticism is now being sharply directed against the present methods of audiometry, and this attitude undoubtedly has some basis in fact.

However standard the use of the discrete frequency audiometer has become as a method of measuring hearing loss, it still leaves many questions unsettled. Chief of these is the relation of this threshold audiogram to the practical disability imposed by a given hearing loss. "We do not live in a world of threshold sound" is the commonest criticism advanced; "The relationship between the audiogram and ability to understand speech is obscure" is another. The ability to hear represents the most vital of all human contacts. Without this sense, verbal communication, the basis of all social intercourse, is eliminated.

Various charts have been constructed indicating the disability resulting from established audiometric hearing losses. Fowler,[2] Steinberg and Gardner,[3] Bunch [4] and Beasley [5] have all presented approximations of the relationship between audiograms and speech intelligibility. At the moment, however, there is no method available for this correlation which is simple, direct and adaptable for general use by the interested otologist or the investigator in the general field of deafness.

Fowler [2] has recently presented a method whereby various factors related to speech intelligibility are "weighted" in proportion to their general importance. The individual frequencies in the speech range of the audiometer are accorded specific values, bone conduction another set, nerve deafness another, tinnitus another, and so on. The sum of the plus or minus weightings determines the ultimate percentage value of the individual frequency. The method is certainly ingenious and represents an exhaustive study of the problem.

For the past three years a study has been conducted in this laboratory, first, to establish a normal threshold for the hearing of speech as related to normal audiograms and, second, to establish a simple and straightforward method of correlating audiograms of impaired hearing with actual speech hearing disability. As a result of this study it is now entirely possible to predict a threshold of audibility for speech from the audiogram or the critical audiogram frequencies from the speech threshold.

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2. Fowler, E. P.: Hearing Standards for Acceptance, Disability Rating and Discharge in the Military Service and in Industry, Laryngoscope **51**:937-956 (Oct.) 1941.

3. Steinberg, J. C., and Gardner, M. B.: On the Auditory Significance of the Term Hearing Loss, J. Acoust. Soc. Am. **11**:270-277 (Jan.) 1940.

4. Bunch, C. C., in discussion on Military Symposium, Tr. Am. Laryng., Rhin. & Otol. Soc. **31**:300-301, 1941.

5. Beasley, W. C.: The National Health Survey: Hearing Studies Series, Bulletin 2, United States Treasury Department, Public Health Service, 1938.

It must be understood immediately that neither the test to be described nor any other test of the kind can take the place of complete audiometric examinations in arriving at an actual diagnosis of the deafness. This is an entirely separate problem. The test does, however, place the subject immediately and precisely in a handicap level group. It supplies the absent factor in the present complete diagnostic study. We have chosen to use the term "speech reception" in the following discussion as being less ambiguous than the term "speech intelligibility."

Any test of hearing, to serve a useful purpose, must be applicable within reasonable limits to all age groups, degrees of normal intellectual capacity and educational levels. The majority of authors have laid considerable stress on the limitations of such tests in relation to high levels of these various factors, forgetting, it would seem, that hearing is being tested and not the deafened person's intellectual attainments. In the following discussion a cross section of such human factors is represented. No distinction has been made, or could be found, in the response of any social or intellectual group. Age is a factor only in relation to the patient's actual vocabulary, and here there is no necessity for writing skill.

METHOD

This speech reception test cannot be considered novel in any sense. Certain aspects at first glance may seem somewhat empiric, but the technic has been set up on a basis of simplicity and speed of performance, accuracy and facility of interpretation and economy of necessary equipment. The last factor may be disposed of immediately. The total expense, provided quiet rooms are available, is comparable to the cost of a standard audiometer, and in a clinic where careful investigation of hearing loss and the result of therapy is being carried out this additional outlay would not seem excessive.

Fletcher [6] stated:

> It is generally recognized that it is almost impossible to obtain accurate results by means of the usual speech methods because of the uncertainties of controlling the intensity of the voice and the noise and acoustic conditions of the testing room.

This authoritative statement gains added significance in relation to the present completely haphazard and inadequate methods employed in testing the hearing of army and navy enlisted or selectee personnel.

The present method is an adaptation for clinical otologic purposes of different types of speech reception tests the reliability of which has already been established. Steinberg and Gardner,[3] in their articulation tests, based the capacity for interpreting speech sounds on the subject's repetition of detached monosyllables of the consonant-vowel-consonant

6. Fletcher, H.: Speech and Hearing, New York, D. Van Nostrand Company, Inc., 1936.

type. The percentage repeated correctly was taken as a measure of the capacity for interpreting speech. In addition, these authors investigated the problem of loudness and interpretability.

Fletcher [6] has described speech intelligibility tests which require repetition verbatim by the patient of sentences delivered either in question or in statement form. For all practical purposes this type of testing seemed of more importance than the syllable method in estab-

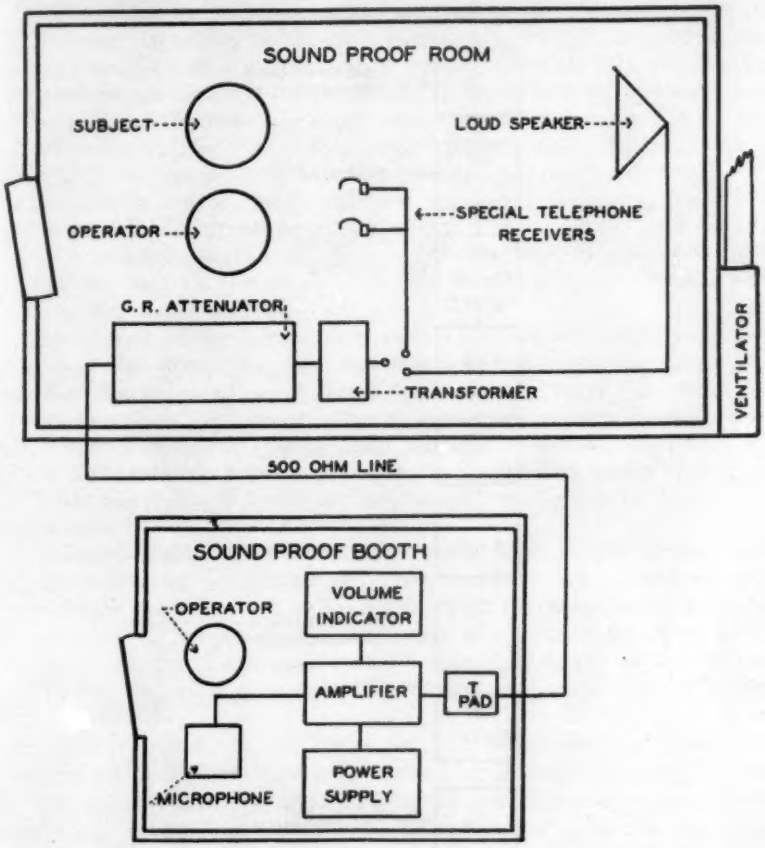

Fig. 1.—Diagram of speech reception apparatus, showing soundproof rooms, the position of the subject being tested and the operators.

lishing a clinical routine and was therefore used in this study. Fowler has stated that "a method for measuring speech intelligibility must be sought." There would seem to be no better method of accomplishing this purpose than actually measuring the intelligibility of speech.

The apparatus employed in this speech reception test is of relatively simple design. It consists essentially of a microphone, an amplifier with a built-in volume indicator, a General Electric radio T pad attenuator and a loud speaker (fig. 1). The microphone and amplifier are located in a soundproof booth. This is con-

nected by a 500 ohm line to the attenuator, which, with the loud speaker, is in an adjoining soundproof room. A transformer couples the attenuator either to a telephone receiver or to the voice coil of the speaker. For satisfactory results with tests of this type it is essential that equipment of good quality be used. The system should be free from frequency and amplitude distortions. Hum and other extraneous noises, which would obviously present a source of interference with

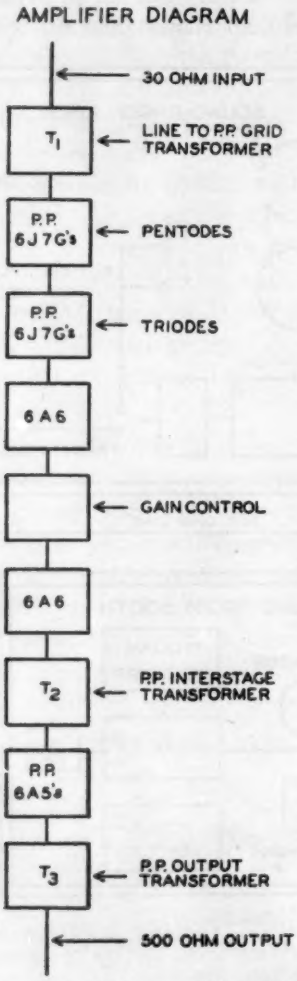

Fig. 2.—Details of construction of the amplifier, situated in the small soundproof booth.

the proper performance of the test, should be at a minimum. The microphone is a Western Electric dynamic unit, type 630 A. Its output impedance is in the neighborhood of 25 to 30 ohms, and the coupling transformer in the system described is within the amplifier proper. The particular unit shown in the block diagram (fig. 2) was built at the laboratory with particular regard to the requirements aforementioned and is of push-pull type throughout. The values of the component parts, such as resistors and condensers, are conventional.

With the physical equipment as indicated, a reader recites a given list of sentences into the microphone situated in the small, soundproof booth. Wide range of choice is afforded by the number of sentence lists available, forty-nine in all. In every test a record is kept of the particular list used. Simpler lists can be devised for children and foreigners with a poor command of the English language.

At this point a paragraph of the chapter on "Methods of Measuring Speech Sounds" in Fletcher's "Speech and Hearing" [6] may appropriately be quoted.

". . . However, a set of simple interrogative and imperative sentences was compiled so as to obtain the approximate relation between the articulation as determined by the standard lists and the intelligibility as determined by the simple test sentences. In making up these test sentences the list was designed to test the observer's acuteness of perception and to minimize demands upon his intelligence. The questions are of a self-evident nature, the answers being frequently implied in the questions. They vary in length from about five to twelve or more words, each sentence containing four or five 'thought' words. These 'thought' words must be correctly received in order to understand the idea of the sentence. Various topics covered by ordinary conversation are represented, including personal experiences and points of interest in politics, science and commerce. An effort was made to eliminate duplicate ideas. In only a few instances were the ideas repeated and in those cases the manner of expressing them was varied. In this manner forty-nine lists of fifty sentences each were compiled."

A reader soon learns to speak at a uniform loudness level, aided by the visual guidance of the volume indicator incorporated in the amplifying system of the apparatus. Excursions of the indicating needle above or below the optimum point are compensated for by using a sufficient number of sentences in each test, the routine number being fifty. In the tests men and women readers can be interchanged arbitrarily, as it has been found that in repeated testing of any given subject identical response levels will be obtained regardless of the quality of the reader's voice.

In contrast to phonograph records, the spoken voice permits of much greater flexibility in carrying out the test and is therefore preferable. The sentences are so spaced—the reader repeats each sentence to himself twice before delivering a new sentence—that the subject will have ample time to repeat the words as heard from the ear phones or loud speaker in the soundproof room. If there is reason for delivering the sentences either more slowly or more rapidly, this can be immediately carried out.

Again, as indicated (fig. 1), the subject and the examiner are seated in the soundproof room. A quiet room is as essential in this test as it is for the routine audiometric examination. The electrical circuit is so constructed that either ear phones can be used to test monaural hearing or the loud speaker to test binaural hearing, the loudness levels in either instance being calibrated to parity. The subject's chair is placed at a fixed distance from the loud speaker—10 feet (3 meters). The operator controls the loudness of the spoken words delivered by means of the General Electric attenuator, which has a maximum attenuation range of 110 decibels. As will be seen, this total range is not usable, as at full loudness speech becomes distorted and both the ear and the apparatus overload and at an attenuation of more than 80 decibels speech is no longer audible to the normal ear.

To determine the threshold of audibility for speech, the level at which the subject first hears the reader's voice is determined. The spoken voice is next presented at a level which can be readily understood, and by graded steps attenuation is introduced until a point is reached below which the subject can no longer repeat at least two thirds of the sentences correctly. As in routine audiometric

practice for establishment of any frequency level, this threshold is determined by approaching it from intensities both above and below the actual level of threshold for speech reception. To avoid any possibility of fatigue the loudness may be increased from time to time if the patient seems to be under too much strain. Under most circumstances the test can be carried out in about the same length of time as is required for securing standard air and bone conduction audiograms. It is, surprisingly enough, accurate to 1 or 2 decibels and can be repeated without

TABLE 1.—*Form Used for Complete Recording of Information in Speech Reception Test*

SPEECH RECEPTION TEST

NAME: E. M. B.
DATE: 3-24-41
RECORDER: E. T.
READER: R. K.
LIST NUMBER: 4
EAR: RIGHT

ATTENUATOR SETTING	SENTENCES CORRECT	INCORRECT
30	III	
40	III	
50	III	
60	𝍸	
70		IIII
65	I𝍸	
66	𝍸	II
50	III	
67	II	𝍸 II
66	III 𝍸	I

greater variation than that expected in repeated audiograms.[7] There is greater facility and interest on the subject's part in repeating connected sentences than in responding to the pure tones of the audiometer. The method of scoring the test is shown in table 1, an actual sample of a test on a normal subject. As can be seen, all information relative to the specific test is recorded. The sentences are scored as correct or incorrect for each intensity used, and the threshold is obtained as already described. The examiner determines correctness either by hearing the sentences himself when testing persons with impaired hearing or, if necessary, by using a duplicate list of sentences when testing subjects with high normal hearing.

7. Witting, E. G., and Hughson, W.: Inherent Accuracy of a Series of Repeated Clinical Audiograms, Laryngoscope **51**:259-269 (March) 1940.

STATISTICAL DATA

In any hearing test of this kind a normal level must be established. For this purpose 104 normal ears, as determined by the history and audiometric and otoscopic examinations, were tested for the speech reception threshold as previously described. The subjects were all healthy young adults, ranging in age from 18 to 34 years. Fifty-six persons were examined, the discrepancy in the total number of ears and the number of subjects being due to lack of time or some other relevant factor. In this particular series the telephone receiver was used exclusively in order to increase the number of ears under test. The spread in these normal audiograms was from — 20 to + 15 decibels for any individual frequency, these high extremes occurring in the upper frequency range, as would be expected.

TABLE 2.—*Statistical Data on Speech Reception Tests Made on One Hundred and Four Normal Ears and Eighty-Seven Ears with Impaired Hearing*

		Averages									
			Audiograms							Percentage Loss	
Classification *	No. of Ears	Decibels of Attenuation for Speech	128	256	512	1024	2048	4096	8192	Audiometer	Speech
A+	22 †	71.8	—0.2	2.3	1.6	—0.5	—2.0	—4.7	—2.9	—0.2	—6.7
A	104	67.3	1.0	3.4	2.7	0.7	0.4	—1.5	0.8	1.0	0.0
B_1	10	57.3	5.0	8.0	10.0	7.5	7.0	9.5	9.5	6.5	14.9
B_2	6	56.2	5.0	5.0	9.2	4.2	15.0	26.7	50.0	7.6	16.5
C_1	6	45.0	6.6	10.8	17.5	23.3	25.8	26.6	18.3	17.8	33.1
C_2	3	43.0	3.3	13.3	23.3	33.3	20.0	43.3	66.6	20.4	36.1
D_1	6	35.7	19.1	25.8	30.8	30.0	20.8	19.2	34.2	21.8	47.0
D_2	10	33.3	16.0	25.0	26.5	35.5	35.0	48.5	60.0	25.9	50.5
E_1	22	25.2	28.4	38.9	41.1	42.3	41.6	45.5	50.7	33.3	62.6
E_2	8	21.1	13.1	25.0	33.1	41.2	44.3	44.3	64.3	31.6	68.6
F	11	17.0	38.2	47.3	51.8	50.4	48.6	55.4	65.0	40.2	74.7
G	4	7.3	45.0	55.0	57.5	65.0	57.5	62.5	65.0	48.0	89.2

* 1 indicates flat audiograms; 2, audiograms for high tone loss.
† Upper quartile or normal ears, classification A.

By averaging the values obtained in the speech reception tests, a norm of 67.3 decibels of attenuation of the maximum intensity of the acoustic system was found to represent the normal threshold level and, by analogy, may be considered comparable to the zero level of the standard audiogram. In this instance the spread was from 60 to 74 decibels of attenuation, the average resulting in the aforementioned figure.

For practical use and purposes of clarity it is essential that statistical material of this sort be arranged in groups. The groupings are classified alphabetically, A being used as the normal standard. In this group 22 ears, or the upper quartile of the 104 normal ears, are classified as A +. This classification includes all ears with a speech reception level of 70 decibels or better.

In table 2 are listed the groupings from A + to G, the number of ears tested in each group, the average decibel attenuation for speech,

the average audiogram frequency levels and the percentage loss for hearing derived from the audiometer and for speech reception. From a statistical standpoint the number of ears examined is significant. In all, 86 ears, of patients ranging in age from 14 to 83 years, with varying degrees of hearing impairment, were examined exactly as described for the normal group. The ears were classified primarily according to their speech reception loss, and it was found that both flat audiograms and audiograms for high tone loss occurred in each group. Consequently, these two types of audiograms were averaged separately,

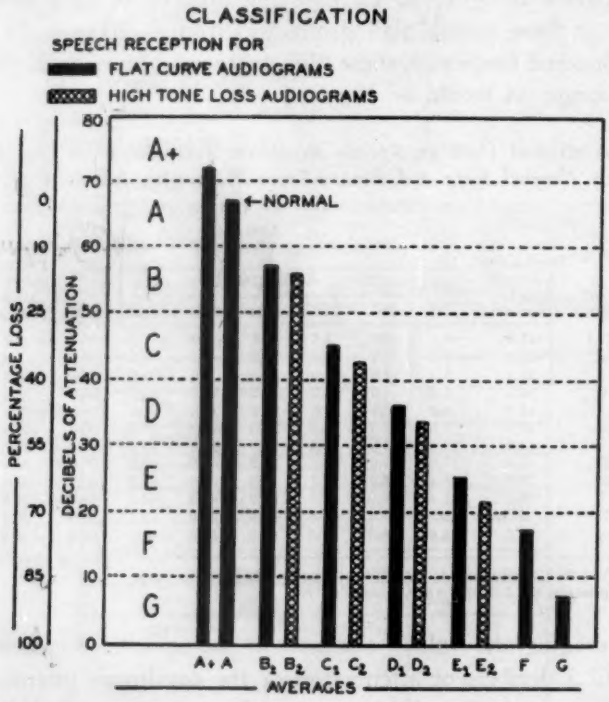

Fig. 3.—Chart showing method of classifying the results of speech reception tests into groups. The scale to the left shows percentage loss as related to decibels of attenuation. The average speech reception for each group is derived from table 2.

the flat curves being designated by the subclassification *1* and the curves for high tone loss by the subclassification *2*. In table *2* the average decibel attenuation for speech is a specific and direct acoustic measurement. Average audiometric percentage loss is computed in the conventional manner by averaging the values for the frequencies 512, 1024 and 2048 and multiplying by 0.8, as determined by the Bell laboratory investigators. Percentage loss for speech is arrived at by determining the observed departure from the established normal in terms of direct arithmetical calculation. The average normal attenuator setting of 67.3 decibels, as previously stated, is regarded as the zero threshold level.

Inspection of table 2 and of figure 3, derived from it, reveals highly significant data. In groups *B*, *C*, *D* and *E* are represented flat curves (*1*) and curves for high tone loss (*2*). It may be assumed that they

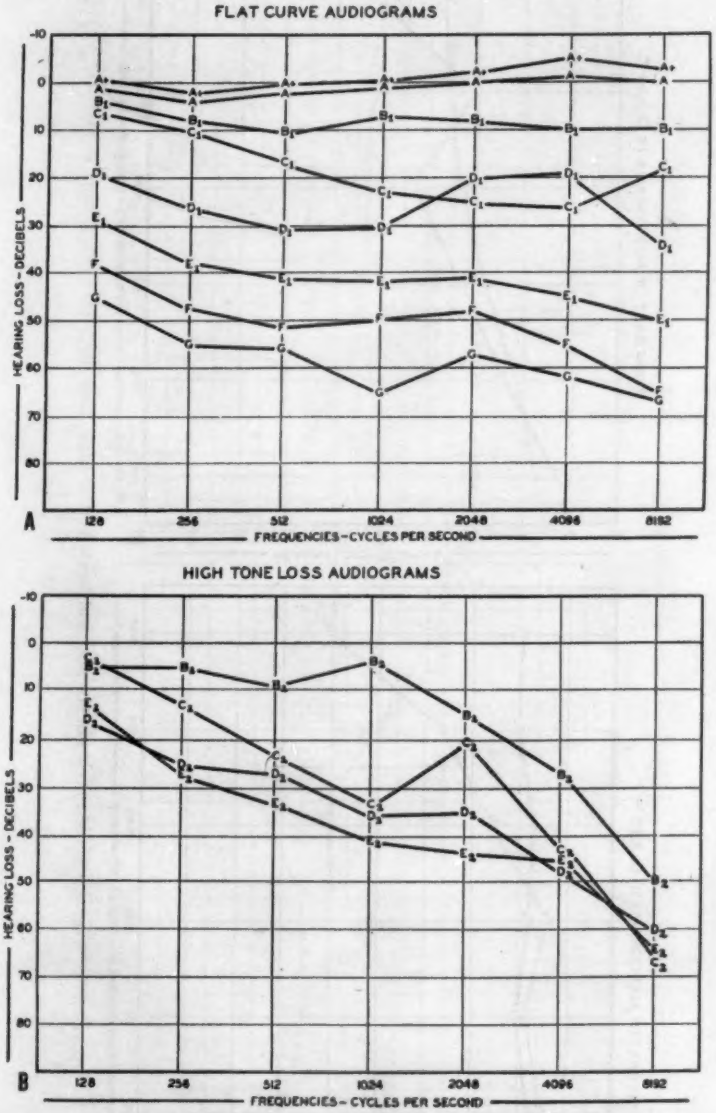

Fig. 4.—*A*, chart of average audiograms in each group with approximately the same amount of loss for high and low tones (flat curve) designated by subclassification flat curve *1*; *B*, chart of average audiograms in each group with high tone loss, designated by subclassification *2*.

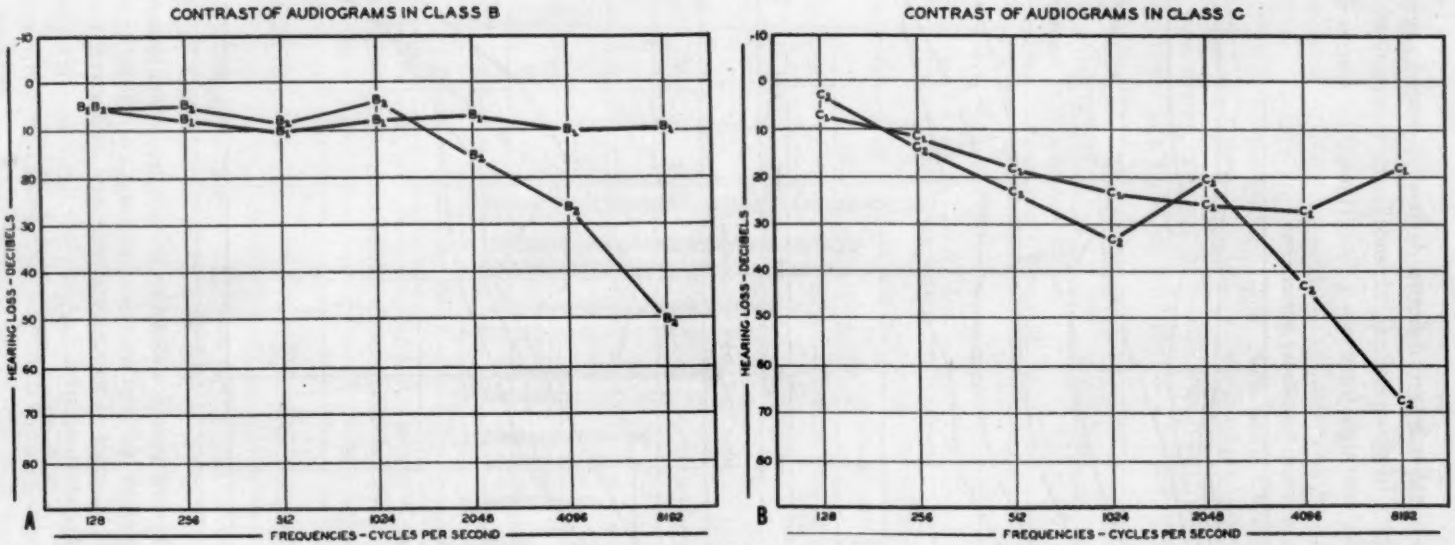

Fig. 5.—Comparisons of average audiometric curves and audiograms for high tone loss of (*A*) group B and (*B*) group *C*.

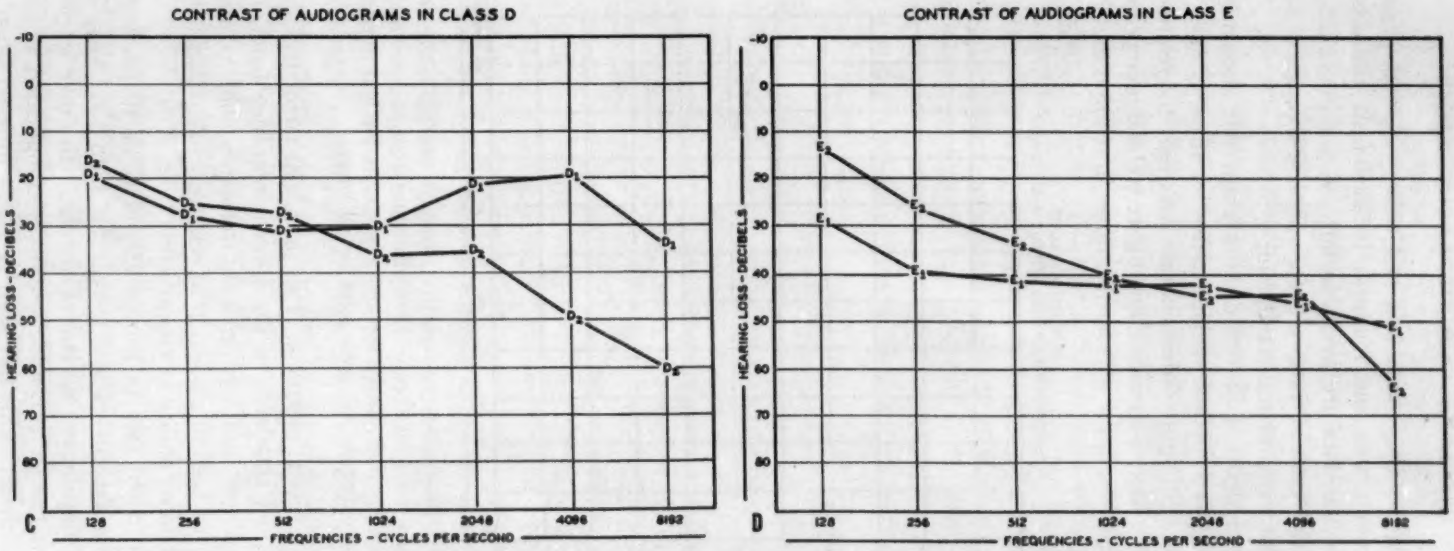

Fig. 6.—Comparison of average audiometric curves and audiograms for high tone loss of (*C*) group D and (*D*) group E.

represent, respectively, conduction and nerve deafness groups. Bone conduction audiograms and loudness balance tests confirm this supposition. Specific data are available but are not presented, since the speech reception levels of the two groups show a completely insignificant difference from any practical standpoint.

A and *B* of figure 4 illustrate the average flat audiometric curves and the audiograms for loss of high tones for these groups. *A* and *B* of figure 5 and *C* of figure 6 demonstrate strikingly the relative unimportance of the two high frequencies, and figure 6 *D* the unimportance of the two low frequencies, in the audiometric range in relation to the all-impor-

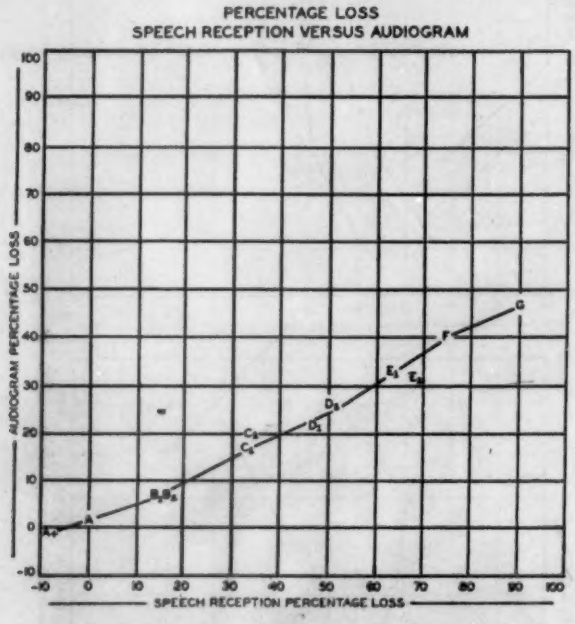

Fig. 7.—Chart showing the relation of percentage loss for speech to percentage loss derived from the audiogram. Note straightness of the curve and the fact that the averages for both flat curves and audiograms for high tone loss in each group fall at approximately the same point on the curve.

tant problem of speech reception. This particular factor falls quite in line with the accepted standards of the speech frequency band, but on the basis of actual test and measurement relegates bone conduction and nerve deafness as such to a position of relatively insignificant importance so far as functional ability is concerned.

It must be noted that in groups *F* and *G* no distinction has been drawn between flat curves and curves for high tone loss, because at such levels of impairment all curves are flat. In other words, at these low levels there can be no conduction loss uncomplicated by some degree of nerve impairment. This fact must be borne in mind when instituting radical therapy for profound deafness. In no case in either group *F*

or group *G* was bone conduction normal; in all instances it was impaired or absent for the high frequencies.

Figure 7 shows a fact of real importance and interest, for it correlates from actual observation, and for the first time on a clinical basis, the relation between audiometric percentage hearing loss and impaired speech reception. These data are derived from table 2. Here it can readily be seen that for a given audiometric percentage hearing loss a relative lowering of speech reception occurs. The curve of this chart is so uniform for both flat audiograms and those for high tone loss that it could probably be continued through any range of deafness. From this figure it can be seen that a 50 per cent audiometric loss is equivalent to approximately a 100 per cent loss for speech under the conditions described. Further impairment renders the deafened person for all practical purposes completely unable to understand spoken voice at any undistorted maximum vocal intensity. In other words, this degree of impairment, and of course anything beyond it, indicates that the patient is under a handicap of total hearing loss unless artificial aid is employed.

SUMMARY

In developing the present method of measuring the ability of a subject to hear and understand speech, we have had two main objectives: first, and probably of most importance, simplicity of performance and appraisal of observations; second, since audiometry is now an established means of testing hearing, direct correlation of the audiogram with some standard speech reception test. The data presented mark in general the accomplishment of these two objectives.

There is little question that judgment in regard to simplicity involves a certain familiarity with the method. However, if the directly measured percentage losses of speech reception, related as they are to normal hearing, are accepted, no further information is necessary other than an individual audiogram. Figure 7 shows a ready means of determining from a glance at an audiogram the actual loss of speech reception.

When the study was undertaken, the standard method of reducing an audiogram to a percentage loss was viewed with adverse prejudice. However, as the factual data have accumulated this position becomes no longer tenable. The relation between audiometric percentage losses and impairment of speech reception is definite and specific. Correlation of the two factors supplies the actual information which the patient seeks when consulting the otologist: loss for total hearing and loss for speech. It presents an appraisal of disability which is practical and readily understandable. Further importance lies in the fact that additional information becomes available for prognostic purposes. Some objection may be raised in view of the fact that in this test, as in audiometric examinations, thresholds of hearing are being used. There is one distinct difference, however, since in the speech reception test

thresholds of intelligibility for speech, not audibility, are being determined. The difference between the two levels is approximately 10 decibels for both normal ears and ears with impaired hearing.

In this range of sound intensities, about 10 decibels above minimum audibility, the level of the bone conduction audiogram has not proved a significant factor, and, as shown by the charts, nerve deafness in any of the groups failed to influence the related disability to any appreciable extent. Further factors concerned with the general problem are tinnitus and the phenomenon of recruitment. Neither one has changed the expected level of speech reception in any individual instance. "Tuned tinnitus" is usually placed at one or the other extreme of the audiometric range and hence does not seem to mask any of the frequencies in the all-important speech band. The data in table 2 support this view, since they demonstrate conclusively that frequencies outside this range are not critical in speech reception. Since the accepted method of averaging the audiogram has been used exclusively, the level of hearing at the frequency of 2896 has not been included in the charts, solely for the purpose of simplicity. It is, however, a matter of record, as the audiometer used in this study includes the intermediate frequencies from 1024 to 8192.

Again, since thresholds are being examined, recruitment has not influenced the speech reception level. Application of this method of examination to the prescription of hearing aids may well demonstrate the role that variable loudness plays in nerve deafness. Although used routinely for this purpose at present, sufficient data are not yet available to make possible any definite statement.

CONCLUSIONS

A method is presented for the determination of the acuity of hearing in relation to speech reception, or the ability to understand speech. A normal level is established, and contrasted with it are the values for a series of groups of persons presenting varying degrees of impairment.

A definite correlation between audiometric percentage loss and the percentage loss for speech has been determined. Though unequal in actual degree, the relationship remains constant throughout the entire audiometric range of intensities, the former representing percentage loss of total hearing and the latter percentage loss for speech.

Bone conduction and nerve deafness as such are not significant factors in the percentage impairment of speech reception thresholds.

Comparison of audiometric and speech reception levels shows that frequencies above and below 512 to 2048 have little significance in the subject's ability to understand speech.

A classification of audiograms in terms of speech reception thresholds is presented.

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MASKING OF THE PATHOLOGIC STATUS IN OTITIS MEDIA BY CHEMOTHERAPY

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Infection of the middle ear is usually benign but occasionally may lead to considerable involvement of the temporal bone or may extend to the brain, the brain coverings or the blood vessels.

Since the advent of chemotherapy there has been controversy concerning the treatment of otitis media and early mastoiditis. Before whole-heartedly subscribing to any new form of treatment for a disease, one should know the mortality, the morbidity and the average expectancy of the previous forms of treatment. Acute suppurative and nonsuppurative forms of otitis media usually subside in a few days or a few weeks. Which are the cases in which the disease will subside spontaneously with ordinary simple remedies and expectant treatment? Which are the cases in which the patient must be treated with the more heroic and more dangerous methods of surgery or chemotherapy? It is not my intention to detract from the known advantage that can be obtained with proper dosages of sulfanilamide and its derivatives in many cases of early mastoiditis or of meningitis of otitic origin, particularly when the invading organism is streptococcus or pneumococcus. Indiscriminate use of chemotherapy for acute otitis media to prevent mastoiditis may be unnecessary; it must not be relied on entirely to care for the complications.

To the otologist, every purulent middle ear carries with it the possibility of a number of serious intracranial complications, and the importance of the early recognition of sinus thrombosis, abscess of the brain or meningitis is obvious. Each differs markedly from the others in the patient's general appearance, in the temperature curve, in the spinal fluid picture and in the effect on the fields of vision and the ocular fundi. The dull, apathetic patient with abscess of the brain stands out in clear contrast to the anxious, restless victim of meningitis or the bright animation of the patient with early thrombosis. The temperature charts are also distinctive. The normal or subnormal curve in the case of abscess, the consistently high temperature in the case of meningitis and the picket fence septic curve of the patient with an infected sinus are individually characteristic.

The laboratory data are rather typical for each entity. The spinal fluid pictures are almost as typical. The high white cell count suggests

the case of suppurative meningitis. Pyelitis and pneumonia demand elimination among differential considerations. A positive blood culture, with the symptoms of sinus thrombosis helps establish the diagnosis. A sterile blood culture with a negative Tobey-Ayer test and a normal white cell count cannot compensate for the importance of a septic temperature curve, a history of chills and sweats, and edema over the emissary vein in a case of postoperative mastoiditis. When the question arises whether a sinus is thrombotic, it is essential to ligate the internal jugular vein and explore that sinus.

Since 1936 an entirely new approach to the problem of infection in the middle ear has been advocated: There is a tendency to prescribe chemotherapy for mastoiditis and its complications. Often the patients demand chemotherapy. Occasionally they begin medication without the authorization of a physician's prescription. It is my experience and that of my associates to find that the administration of the drug has usually been stopped as soon as the discharge from the ear ceases, and many physicians stop the administration of the drug as soon as the temperature becomes normal. It is self evident that many patients do not get an adequate dosage. This group of inadequately treated patients later reach the otologist with a necrotic condition of the mastoid and other complications with no elevation of temperature, no pain, a normal white cell count and negative roentgen findings. The true picture is masked, and it is difficult for the otologist to arrive at a proper diagnosis.

In a series of 16 patients treated for sinus thrombosis by Dr. D. S. Cunning and myself before the advent of chemotherapy the end results differed radically from those obtained in patients by the use of chemotherapy. In the nonmedicated group the ages varied from 11 months to 77 years. The duration of discharge varied from four to fifty-two days. Nine patients had both ears and 7 had one ear involved. Ten had undergone mastoidectomy within the month, either unilateral or bilateral. A septic temperature was present for periods of from one to thirty-two days. Fourteen of the patients had positive blood cultures. The organisms isolated were hemolytic streptococci in all except 1 case and the organism in that instance was Streptococcus viridans. The white cell counts ranged upward from 12,800. There were clots in the sinus in all cases except 1, in which their presence was questionable. Bleeding from the bulb of the jugular vein was found in 5 cases. Bleeding from the torcular was encountered in all but 1 instance. The Tobey-Ayer test was positive in 7 cases. Eight of the patients had chills of varying intensity. The eyegrounds showed blurring in 9 cases, with papilledema in 2 of these. Only 1 of the patients died, despite the fact that 7 of them had metastatic abscesses.

Dr. John R. Page, surgeon-director of the Manhattan Eye, Ear and Throat Hospital, consented to the inclusion of the results of a questionnaire dealing with this problem. The questionnaire was sent to 70 pediatricians and 135 otologists on Oct. 23, 1940. The answers received are compiled here.

1. In a case of acute purulent otitis media, do you think sulfanilamide should be prescribed as soon as the diagnosis is made?

81 otologists and 39 pediatricians answered "No"	Against	120
8 otologists and 10 pediatricians answered "Yes"	For	18

2. Or do you think a culture of the discharge, a blood count and a urinalysis should be obtained before its use is decided on?

79 otologists and 37 pediatricians "Yes"	For	116
10 otologists and 14 pediatricians "No"	Against	24

3. Do you consider its use justifiable in ambulatory patients?

60 otologists and 39 pediatricians "No"	Against	99
27 otologists and 10 pediatricians "Yes"	For	37

4. If the patient's condition is progressing favorably without it, do you feel justified in not prescribing it?

66 otologists and 31 pediatricians "Yes"	For	97
28 otologists and 18 pediatricians "No"	Against	46

5. Or do you think that sulfanilamide or sulfapyridine should be given as soon as possible in all hemolytic streptococcus and pneumococcus infections, unless its use is contraindicated by some unusual condition?

65 otologists and 29 pediatricians "No"	Against	94
28 otologists and 21 pediatricians "Yes"	For	69

6. Do you think it important to ascertain daily the concentration of the drug in the blood?

45 otologists and 14 pediatricians "Yes"	For	59
39 otologists and 36 pediatricians "No"	Against	75

7. Does the possibility of its masking symptoms and causing late serious involvement in the mastoid influence you to use it only in selected cases, or in cases with severe complications?

70 otologists and 26 pediatricians "Yes"	For	96
19 otologists and 20 pediatricians "No"	Against	39

The tabulation of the replies gives a consensus which is of interest. The fact that only about 5 per cent of those who had acute purulent otitis media before sulfanilamide came into use had to be operated on for mastoiditis has influenced Dr. Page's final opinion. In 836 cases collected in 1934, fifteen different causative organisms were found. In 30 per cent the infecting agent was the hemolytic streptococcus, and in 8 per cent of these cases mastoidectomy was done. In 14 per cent the organisms were pneumococci of type III, and in 11 per cent of these cases mastoidectomy was performed. In 14 per cent the otitis was

caused by Staphylococcus aureus, and in 4.2 per cent of these instances mastoidectomy was done. Mastoidectomy was performed in 42 (5.1 per cent) of the 836 cases. Dr. Page was inclined to reserve this drug for the obviously severe infections in cases in which its action could be watched, and to withhold it from 95 per cent because 5 per cent might show specific indications.

Some case histories are recited to demonstrate the difficulties occasionally encountered because of reliance on chemotherapy.

REPORT OF CASES

CASE 1.—A 6 week old white girl was brought to the hospital because of a discharge from the left ear of twenty days' duration. "Boils" had appeared on the buttocks, the right elbow and the right wrist. The impression given at this time was one of multiple abscess, purulent rhinitis and otitis media of the left side. Sulfathiazole (2-[paraaminobenzenesulfonamido]-thiazole) was given at the rate of 7½ grains (0.48 Gm.) per dose for four doses at intervals of four hours. After a surgical consultation, the abscesses were opened. The next day the following opinion was expressed. "The whole picture is not a typical one, because of chemotherapy; the child probably has thrombosis of a jugular bulb." The child was not operated on, for it was contended that the absence of a spiking temperature curve, the gain in weight and the negative culture all mitigated against this diagnosis. Sixteen days later the infant died, and autopsy revealed bilateral otitis media, bilateral mastoiditis and thrombosis of the right lateral sinus.

It is not my contention that an operative procedure would have altered the outcome. It is my contention, however, that a typical picture of sinus thrombosis was not present, and early surgical intervention in the case of sinus thrombosis is imperative. As noted in the foregoing section, in 16 consecutive cases in which I operated in conjunction with Dr. Cunning before the advent of chemotherapy, only 1 death occurred.

CASE 2.—A 7 week old white boy was admitted with a swelling of the left hand. The right drum membrane was red and full. The first thought was cellulitis of the left hand with otitis media on the right side. Twenty-four hours later bilateral myringotomy was performed. Thin straw-colored pus was obtained, and chemotherapy was started; 5 grains (0.32 gm.) was given as the initial dose and thereafter 2½ grains (0.16 Gm.) four times an hour. The chemotherapy was continued, and sixteen days later the right ear was found discharging thick creamy pus. The left ear showed no abnormality. In view of the chemotherapy, despite the findings and the lack of operative indications, the thought was expressed, "This child may have acute mastoiditis with thrombosis of the jugular bulb on the right, and surgical intervention may be advisable." The temperature during the first two days did not go above 100 F. The temperature during the next eight days did not go above 99 F. The temperature during the next month did not go above 102 F. At that time operation revealed mastoiditis on the right. The sinus was white and apparently collapsed. Two days later ligation of the jugular vein was done. The lateral sinus was plugged at the jugular and torcular ends. The sinus was opened and on removal of the jugular plug, a clot about the size of a pea was noted. Free pus exuded from the jugular bulb; free bleeding was found.

This patient with sinus thrombosis had no typical picket fence temperature curve, no positive blood culture, no increased white cell count, no eyeground changes. None of the usual signs or symptoms of sinus thrombosis was present. The only presentation favoring a diagnosis of sinus thrombosis was the discharging ear and the abscess of the hand plus the all-important fact that the child had been treated with chemotherapy. On that basis a diagnosis of an intracranial complication was made and established at the time of operation.

CASE 3.—A 24 year old man was admitted on Jan. 25, 1940, complaining of severe pain in the left ear. The ear was opened, and free pus was obtained, under pressure. I did not see the patient again till February 12. In the interim he received medical attention because of pain in the hands, wrists and arms. On January 29, he was again admitted with a diagnosis of rheumatic arthritis. Treatment with sulfanilamide was begun immediately, with 12 grains (0.77 Gm.) being given every four hours. On February 2 a blood culture was positive for streptococci. Cultures on February 6, 7 and 12 were all positive. On February 12 the spinal fluid showed 2 cells per cubic centimeter and no sugar reduction. On January 30 a roentgenogram of the hands showed no evidence of periostitis or osteomyelitis. On February 5 roentgenograms of the mastoids showed no change. The patient's temperature from January 29 through February 14 never went beyond 103 F. and was usually down to 99 F. Sulfanilamide was given on January 29 through February 2, totaling 152 grains (9.83 Gm.). Since one of the blood cultures suggested a pneumococcic infection, treatment with sulfapyridine (2-[paraaminosulfonamido]-pyridine) was started February 9 and was continued through February 12 for a total dose of 112 grains (7.24 Gm.). On February 12, eighteen days after the initial myringotomy, the patient's state was desperate. The ears at this time showed no symptoms referable to mastoiditis. It was my impression, however, that chemotherapy had disguised the true picture. Our tentative diagnosis was acute mastoiditis on the left with an intracranial complication. At operation a small perforation about the size of a green pea was noted in the cortex of the bone, through which white blood oozed. The initial groove was entered through this opening. It was found very necrotic with pathologic exposure of the sinus and the dura. The poor state of the patient compelled interruption of the procedure. On February 15 the jugular vein was ligated, the old wound was entered, and immediately the lateral sinus was seen to be exposed pathologically. After the jugular and torcular ends had been plugged, the sinus was entered with a Bard Parker knife. A large clot was found extending deeply toward the jugular bulb. The patient was in very poor condition when returned to bed and died two hours later. Consent for an autopsy was not obtained. From the clinical and operative findings the cause of death was lateral sinus thrombosis, septicemia and mastoiditis on the left.

The 3 cases just detailed are representative of the confusion that may be caused by chemotherapy. Five similar instances in which chemotherapy clouded the issue have been encountered in the last four months. Four patients died with masking of the classic symptoms of the complications of progressing otitis media. The ages of the 5 patients ranged from 7 weeks to 6 years; 3 of the patients were boys and 2 were girls. The duration of

the discharge varied from twelve to twenty-five days. Two of the patients had unilateral aural disease and 3 bilateral. On none of these patients had mastoidectomy been done. Those showing unilateral otitis also showed one-sided mastoid involvement. Those with bilateral otitis showed mastoid involvement on both sides. Septic temperature was observed for periods varying from thirty-five to fifty-one days and never rose above 102 F. Postoperative culture of material from the mastoid showed Streptococcus haemolyticus in all 5 cases. Culture of the blood gave negative results in both cases of one-sided mastoiditis, whereas in the cases of bilateral disease it gave one negative and two positive results. In both cases of unilateral disease smears showed no organisms, whereas among the 3 cases of bilateral disease there was a negative culture in 1 instance and also a negative smear. The white cell counts varied from 17,500 to 23,000. In all cases there was clot in the lateral sinus, with bleeding from the bulb and the torcular. In none of these cases was there evidence of chill or of blurring of the disks. Of the 5 patients, 4 died and 1 recovered. The 4 who died showed metastatic abscesses. A pertinent observation is the differences of opinion as to whether the patients died from abscess of the brain or from sinus thrombosis. Since no permission for an autopsy was obtainable in any case, one cannot arrive at an absolute conclusion.

SUMMARY

Acute suppurative otitis media is, as a rule, a self-limiting disease. Eighty per cent of unselected clinic patients get well in less than four weeks. A higher percentage get well if the canal is kept clear, the mucosa shrunken and proper care given to the eustachian tube. A higher percentage get well if the disease is nonsuppurative. A large percentage of the cures attributed to chemotherapy may include the spontaneous remissions.

Since the advent of chemotherapy my associates and I have observed that the classic signs and symptoms of sinus thrombosis are often disguised so as to render a positive diagnosis difficult. The promiscuous use of chemotherapy in cases of otitic infection tends to delay accurate diagnosis and surgical intervention. The delay in surgical intervention accounts for the increased mortality in the cases of complications of otitis media recently noted in our experience. Chemotherapeutic temporizing with middle ear suppuration tends to delay life-saving surgical operation in the cases in which there are serious complications.

CONCLUSION

Chemotherapy usually masks the classic symptoms of progressing otitis, and the treatment of the individual patient may be conditioned

by this fact. If involvement of the lateral sinus is suspected, it is wise not to complicate the picture by chemotherapy, which will only prolong the course of the disease. Chemotherapy cannot replace surgical treatment if an undrained necrotic focus is present.

To prescribe a drug in an indiscriminate fashion in all cases of otitis media seems unwise. There exists the danger of sensitizing the patient, injuring the liver or the kidneys, or rendering the patient drug-fast. By using chemotherapy for a minor ailment one may be denying the patient its benefits for a serious infection at a later date.

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REFLEX EFFECTS PRODUCED BY ABNORMAL MOVEMENT OF THE LOWER JAW

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Study of the pain effects and the reflex irritative functions in 400 cases in which destruction of the mandibular joint was suspected has made possible a fair standardization of the symptoms associated with this change. At first cases were selected in which pains simulated those of diseased nasal sinuses, and subjective symptoms related to the hearing mechanism were included.

A syndrome [1] was proposed to embrace the symptoms related to dysfunction of the temporomandibular joints. As the number of cases increased in which proper balance of the occlusion relieved the primary pain symptoms, other complaints, such as burning sensations in the tongue and pharynx, salivary disturbances and herpetic eruptions in the buccal mucosa and external ear, assumed more importance. In a study of the etiology of glossodynia,[2] these symptoms were mentioned as present in about 10 per cent of cases of the syndrome. This proportion has greatly increased as the series grows larger, pain in the tongue, pharynx or hard palate being present in 23 per cent.

The majority of all symptoms are localized about the ears and vertex because of the proximity of the mandibular joint. Stuffy sensations and tinnitus, which are relieved when the other symptoms are eliminated, occur as part of the picture, but the relationship of deafness is difficult to prove. In earlier cases tuning fork and voice tests were employed. In these cases hearing distance was found to improve after reposition of the jaw, and the explanation offered was aid to ventilation of the eustachian tubes, by restoring the proper tension to the soft tissues and suspensory ligaments which border the tube

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Read before the Section on Laryngology, Otology and Rhinology at the Ninety-Third Annual Session of the American Medical Association, Atlantic City, N. J., June 11, 1942.

1. Costen, J. B.: A Syndrome of Ear and Sinus Symptoms Dependent upon Disturbed Function of the Temporomandibular Joint, Ann. Otol., Rhin. & Laryng. **43**:1-15 (March) 1934.

2. Costen, J. B.: Glossodynia: Reflex Irritation from the Mandibular Joint as the Principal Etiologic Factor, Arch. Otolaryng. **22**:554-564 (Nov.) 1935.

The reason for habitual impaction of the eustachian tube in case of the overclosed lower jaw was demonstrated by overclosing the lower jaw of a soft tissue specimen, cut in a plane along the entire length of the tube. The soft tissues were seen to bulge and close the tube by pressure on its membranous anterior wall. This appeared to explain why the usual function of intermittent opening of the tube was embarrassed during overclosure and to account for the occurrence of deafness and the sensations of low buzzing, tinnitus, stuffiness in the ears and dizziness. In the case of a 72 year old man with serous otitis, all forms of treatment were resisted for weeks, until it was found that he never wore his lower plate because of discomfort. When the plate was adjusted and worn constantly, the serous otitis cleared up without further local treatment. The effect of overclosure in producing stasis in the eustachian tube and middle ear was clear, and simulated catarrhal deafness. It was relieved only by opening the patient's bite to normal occlusion and removing the effect of overclosure on the tubes.

However, in the more recent, and larger, part of this series the results of audiometric tests made on all patients complaining of deafness do not confirm the improvement noted when voice tests were used. Whatever improvement was shown in the earlier cases must be attributed to increased attention and well-being after relief from painful and exhausting reactions incidental to movement of the lower jaw. Guild [3] offered an anatomic explanation of eighth nerve deafness in a few cases in which microfractures extended from the region of the wall of the external canal into the otic capsule. Tinnitus has been explained by Seaver [4] as a protective neuromuscular reflex within the middle ear, originating in irritation in the mandibular joint. An interesting case is selected from the group with symptoms referable to the ear.

CASE 1.—J. M., aged 51, a physician, had a history of only one important illness, pneumonia due to pneumococcus type III, in December 1938. After his recovery a hissing tinnitus began in the left ear, which was distracting to the point of interfering with his work. He noted increasing deafness, nervousness and physical instability which caused him to give up his practice. He had various examinations, the last at the Mayo Clinic, where he was found to be normal except for mild neurosis.

Examination at the Barnes Hospital on Aug. 8, 1939 revealed that the throat, nose and ears were normal. Maloccluding natural teeth carried many fillings and inlays. The motion of the lower jaw showed evidence of fixation of the left condyle, both

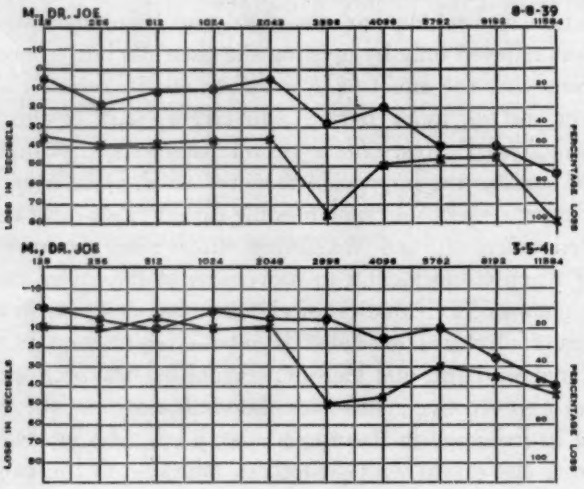
3. Guild, S. R.: The Probable Role of the Muscles of Mastication in the Causation of Microfractures of the Human Temporal Bone, Anat. Rec. (supp.) **61**:20-21 (March) 1935.

4. Seaver, E. P., Jr.: Temporomandibular Joint Malocclusion, and the Inner Ear, a Neuromuscular Explanation, Ann. Otol., Rhin. & Laryng. **46**:140-149 (March) 1937.

condyles weaving widely to the left and shifting straight backward on closure. The mandibular joints were not tender to palpation, and there was no painful movement of the jaw. No trismus was noted. Audiograms showed loss for all tones, as shown in the chart, the impairment being more extensive in the left ear. Because of normal bone conduction, the diagnosis of mixed deafness was made. Mouth reconstruction to balance the occlusion was advised.

On March 4, 1941 he was again examined, his dental reconstruction having been complete about a year. The excursion of the lower jaw was normal, and no further tinnitus was heard. An audiogram showed return of all tones below 2048 double vibrations to within 5 per cent of normal in both ears, the curve above this point remaining about the same.

By far the most important data resulting from the greatly increased interest in the mandibular joint syndrome have been concerned with



Audiograms in case 1. Hearing was referred to the right in the Weber test, and there was a diminished positive Rinne reaction. Bone conduction was not changed.

the irritative pain effects. Change from the normal smooth excursion of the lower jaw, such as crepitus in the mandibular joints or shifting of the condyles laterally or sagittally in the condylar path, gives the first clue to the origin of pain effects. Production of pain in the tongue when the temporomaxillary articulation was involved by inflammation was recorded by Butlin [5] in 1885. Recognition of the syndrome in many cases of supposed trigeminal neuralgia in which relief was obtained by suitable dental plates to control the relation of the condyles was reported

5. Butlin, H. T.: Diseases of the Tongue, London, Cassel & Co., 1885, p. 417.

by Brown [6] in 1912. Ten cases were selected from the first hundred in the present series and reported in 1935 [2] as examples of glossodynia and burning pains about the pharyngeal wall caused by painful reflexes from the mandibular joint, the mechanism being irritation of the auriculotemporal and chorda tympani nerves, referred to the lingual and glossopharyngeal nerves.

The distribution of reflex effects is indicated in the table. The series includes 16 cases of ticlike pain which could not be proved to be major tic. In 6 of these 16 cases the fifth nerve roots were sectioned, and of these, remarkable relief was obtained in 2 by support with proper dentures and fixation of the lower jaw with an elastic headband. One

Summary of Signs and Symptoms in Four Hundred Cases of the Temporomandibular Syndrome *

Subjective Symptoms		Objective Signs	
Otalgia of all grades and pain in the mandibular joint	152	Tenderness of mandibular joints to internal palpation	159
Pain about eyes, cheek or parietal region	107	Shift of lower jaw or condyles laterally or backward	146
(*a*) Lancinating, ticlike	16	Malocclusing natural teeth	133
(*b*) After neurosurgical procedures	6	Edentulous jaws	128
Burning, soreness or drawing pain in tongue or pharynx	92	Partial loss of molar teeth	88
Pain to occiput, vertex and neck	91	Trismus; total or partial restriction of motion of lower jaw	56
Perioral burning	9	(*a*) Impacted molar teeth	6
Pain along lower jaw (except in cases of osteitis)	7	(*b*) Osteitis of lower jaw	2
Painless reactions		(*c*) Parotid tumor	2
Crepitus	69	(*d*) Caries and root abscess	6
Tinnitus	52	(*e*) Furuncle in external auditory canal	10
Deafness	50	(*f*) Depressive psychosis	1
Vertigo	46	Herpes of the buccal mucosa or external auditory canals	32
Stuffiness in ears	24	Reduction in saliva	19
Illusions of copper and salt taste	7	Increase in saliva	7
		Dissimilar metals in fillings producing galvanism	5

* In this series there were 324 females and 76 males.

or more of the symptoms appeared in each case, but are tabulated separately. The proportion of cases representing each symptom is about the same as that in a series of 200 cases studied by Seydell.[7] Roentgen ray findings, which included relaxation or ankylosis, erosion of bone structures and asymmetry in position of the condyles were not included.

On the basis of the premise that the lack of molar support, or uneven molar support, permits the condyle to impact and destroy portions of the mandibular joint, thus impinging on sensory nerves within its structures, at one stage in the study of this series (after observation of 125 cases) it seemed clear that painful reflexes "invariably occur on the side in which proper molar support is lost." Exceptions to this rule appeared when it was noted that in some cases the pain symptoms

6. Brown, G. V.: The Surgery of Oral Diseases and Malformations, Philadelphia, Lea & Febiger, 1912, p. 321.

7. Seydell, E. M.: Personal communication to the author.

were exhibited on the side opposite that in which changes in the joint were shown or molar support was lost. The sequence in which this change occurs seems to begin with the involvement of the mandibular joint on one side, and as it becomes even mildly uncomfortable, this joint is guarded at the expense of loosening the joint on the opposite side. This fixation of the side first affected may be not only a part of the chewing mechanism but also the result of unilateral trismus on that side. The joint on the opposite side loosens to accommodate excursion of the lower jaw and becomes the one producing most of the symptoms. Some patients were able to recall that their otalgia and other pains appeared first on one side and later, and more severely, on the other.

This raises the question of the most important factor in the destruction of the mandibular joint, and that is trismus, the tonic contraction of the muscles of mastication. Severe trismus has been commonly described in association with hysteria, tetanus, tetany, inflammation of the parotid glands, deep pharyngeal abscess and injuries and periostitis of the mandible. The jaws are closed by the strong action of the temporalis, masseter and internal pterygoid muscles. That a milder type of trismus could occur on one side only and be continued by some subpainful type of stimulus was evident only after 23 cases in the series were studied [8] and the inciting factor was identified. This factor appeared to be any sensory stimulus occurring in districts supplied by the third division of the fifth nerve. Such irritation could reflect an impulse by way of the motor branch of this nerve to the three muscles of mastication, tensing them and thus producing a slight impacting effect of the condyle within the mandibular joint. This analysis of trismus was described in earlier studies pertaining to difficult eruption of the last molar, or wisdom, tooth in lower jaws in which the angle between the ramus and body of the jaw was small (Huber [9]).

The cases of trismus were classified in five groups according to the origin of the sensory irritation.[8]

1. Sources of inflammatory irritation about the ear and jaw, such as carious teeth, infection of the external auditory canal secondary to epithelioma or simple furuncle in the external auditory canal.

2. Trauma delivered primarily to the temporomandibular joint, as by a blow on the chin, enforced stretching of the joints by new dental plates, subluxation after a wide yawn or unusual wide opening of the mouth, such as in biting an apple.

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8. Costen, J. B.: The Mechanism of Trismus, and Its Occurrence in the Mandibular Joint Dysfunction, Ann. Otol., Rhin. & Laryng. **48**:499-514 (June) 1939.

9. Huber, G. C.: Piersol's Human Anatomy Including Structure and Development and Practical Considerations, ed. 9, Philadelphia, J. B. Lippincott Company, 1930, p. 244.

3. Gradual destruction of the joint, the result of various forms of malocclusion of the original teeth.

4. The subpainful stimulus originating in impacted molars.

5. Actual destructive lesions slowly produced in the mandibular joint, with painful irritation within the joint remaining as the most important source of irritation. Case 2 belongs to this group.

CASE 2.—I. M. E., aged 66, a white woman, suffered fracture or separation of bone of the tympanic plate, followed by agonizing otalgia with any movement of the lower jaw. There was no known injury to the lower jaw to account for the pain.

She was admitted to the medical service of Barnes Hospital, on Dec. 18, 1940, with the chief complaint of persistent severe pain in the left side of the face, of four years' duration. The pain was sharp and lancinating and extended from a point just in front of the left ear to the nose just below the molar eminence; it also extended along the lower border of the left jaw.

Her past history was without significance; the teeth were extracted ten years before, but dentures had not been used in recent years because the pain was greatly increased when they were worn.

Physical Examination.—The patient assumed a flexed position in bed, holding the left side of her face. All areas about the left ear and the lower jaw were tender to external palpation, and internal palpation of the left mandibular joint was intensely painful. The gums were edentulous, and three vesicles appeared on the upper left alveolar ridge. On opening and closing the mouth, a loud, grating crepitus was observed in the left mandibular joint.

Roentgenographic studies by Dr. Sherwood Moore showed a well defined gap in the anterior wall of the external auditory canal. Laminagrams of the temporomandibular joints established this thinning or break in the anterior wall of the external auditory canal.

As a test, the lower jaw was fixed by an elastic headband with the dentures in place for several hours. Then a cork disk, 2 mm. in thickness, was inserted between the molar teeth of the dentures. Partial relief of pain was obtained with such fixation and complete relief the next day, when disks 4 mm. in thickness were inserted to separate the jaws on both sides.

When discharged, on December 25, the patient was advised to have new dentures to raise the bite and to fix the lower jaw on the new plates with the headband indefinitely, except when eating.

COMMENT

The relationship of dysfunction of the mandibular joint to tinnitus is closer than to proved deafness; yet there occurs an occasional case in which the audiogram shows improvement in the range of catarrhal deafness after balance of occlusion.

Perioral burning or prickling of the lips occurred in 9 cases, and in not a single instance did this symptom improve, even when other irritative reactions disappeared after the occlusion was balanced.

The gross trismus reactions were studied in 56 cases, and in 26 of these various origins of trismus, such as impacted molar teeth, could be

shown. In the remainder the trismus cycle appeared to be continued by irritation originating within the mandibular joint.

Wide lateral and backward shift of the condyles could be observed in 139 cases of the entire series. A history of crepitus on motion of the jaw was obtained and the condition found to be present in 61 cases, the destructive processes occurring along the condylar path and preventing smooth motion of the condyles.

The roentgenographic findings which are associated with such trismus reactions are (*a*) limitation of forward excursion of the condyle on the tubercle, with compression; (*b*) compensatory extraexcursion of the condyle into the soft tissues, due to loosening of the joint capsule on the opposite side, and (*c*) asymmetric condyle positions in closure of the jaw.

ABSTRACT OF DISCUSSION

DR. BRASWELL E. COLLINS, Waycross, Ga.: Dr. Costen has given a splendid report on 400 cases of a disorder of increasing occurrence. Each succeeding decade of life results in more wear of the natural teeth or the loss of them.

It is important that all physicians, especially otologists, interest themselves in this work, because in most cases patients suffering from disturbances of the temporomandibular joint consult their physician first. The symptoms are reflex, and therefore misleading. It never occurs to patients that the problem is a dental one. The treatment is entirely up to the dentist, but it falls to the lot of the physician to make the diagnosis. An examination of the eyes, ears, nose and throat should always be made in connection with the search for disturbances of the mandibular joint.

Correction may be easy and consist simply of continual wearing of plates recently taken out of the mouth and set aside by the patient. The majority of the patients are past middle age, and the treatment may be long and tedious. This is especially true if the abnormal joint movement and the complaints have been of long duration. Temporary appliances, such as cork disks and the elastic headband, for fixation should be kept in mind and used when needed.

The most common type of patient is the person who has lost molar support through extractions of posterior teeth and failure to have appropriate replacements. Since the teeth, particularly the molars, act as nature's brakes to prevent the dislocation of mandibular condyles upward and backward, the loss of such teeth would permit this displacement. The increase in the vertical dimension must be built up in the molar region of the jaw, and the process should not be simply one of "opening the bite" with thicker dental plates. Skilful work by the dentist can accomplish this.

Attention to Dr. Costen's table reveals interesting observations. Pain was a predominant subjective symptom; 152 patients had otalgia, 107 pain in the parietal region and 91 pain in the vertex. Only 50 patients were deaf; 133 had malocclusing natural teeth and 128 were edentulous.

I wish to emphasize the importance of increasing considerably the vertical dimension. The average minimal amount is about 4 mm. but this may need to be much greater, as was exemplified in case 2. In that case the vertical dimension was increased at first only 2 mm., and later 4 mm. In a paper on this subject a few years ago (*J. Kansas M. Soc.* **36**:315-321 [Aug.] 1935), Dr. Costen reported a case in which the vertical dimension was increased 14 mm. This was done in stages during a period of five weeks.

I wish to report a case typical of this group.

Mrs. G. W., aged 50, complained of pain in the right ear and right parietal region, of several months' duration. Impaired hearing was noticeable but was less annoying than the pain. Examination of the eyes, ears, nose and throat revealed normal structures. Malocclusion was prominent, being produced by an ill fitting set of plates she had worn for five years. The alveolar bone was resorbed and the gums were shrunken. On dental consultation and correction support was reestablished by increasing the vertical dimension 5 mm., with repositioning of the lower jaw. Two months later, in October 1940, the patient was fully recovered. There has been no return of her complaints.

Dr. A. E. Bennett, Omaha: All who have followed Dr. Costen's painstaking investigations on the mandibular joint syndrome have obtained practical information enabling them to relieve many suffering patients. These studies have been especially helpful to neurologists; many patients formerly mistreated as neurotic, because of glossodynia with fear of carcinoma, or subjected to nerve resection for tic douloureux now, with an accurate etiologic diagnosis, are relieved by properly fitting dentures.

Almost all my patients with this condition consult me because of atypical trigeminal or glossopharyngeal neuralgia. If associated with glossodynia or herpes, the clinical diagnosis of temporomandibular joint syndrome is almost certain. In most instances a definite trigger zone in the pathologic joint can be demonstrated by having the patient chew, shift the condyles laterally or move the mandible or by exerting direct pressure or percussing over the medial or the lateral aspect of the joint. Roentgenographic examination confirms the diagnosis by demonstrating absorption of bone at the point of abnormal pressure, flattening of the condyle of the mandible or narrowing of the intra-articular space, due to absorption of the cartilage.

A large percentage of my patients have obtained satisfactory relief by repositioning the jaw with dentures. In some instances many months must elapse before permanent relief is maintained. In 1 case, after recurrence of pain for about a year, resection of the fifth nerve was performed. Recently, I saw a case in which trigeminal neuralgia developed bilaterally in a patient with generalized muscular atrophy who had been edentulous for years.

One should remember that this syndrome is often caused by removal of molar teeth and failure to replace them with proper dentures. Years later there appears one or more of the symptom complexes outlined by Dr. Costen, and the patient makes the rounds from physician to physician before obtaining a proper diagnosis and relief. It is surprising how many cases of this syndrome are unrecognized by uninformed practitioners. It seems to me that far too many unnecessary extractions of molars are being performed, little or no thought being given to the fact that such patients are all potential sufferers from this syndrome.

I was surprised at the low incidence of tic pain, there being only 16 out of 400 cases in this series. I see about a dozen cases of tic pain each year. On the other hand, I see none of tinnitus or deafness and few of vertigo.

Dr. James B. Costen, St. Louis: Dr. Collins cited a case in which I had recorded relief of symptoms in six or seven weeks. The patients require, or most of them do, long, gradual balancing of the occlusion. The more difficult the problem that the dentist has, the slower he builds up the support, and if he is encouraged to build it up too rapidly, he probably ruins the opportunity to relieve the patient, as well as to balance the occlusion.

722 Beaumont Medical Building.

Case Reports

ACCIDENTAL VACCINIAL INFECTION OF THE NOSE

Review of the Literature and Report of a Case of Laboratory Infection

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Accidental nasal infections with vaccinia have undoubtedly occurred in the United States, but the case to be reported seems to be the first in the American literature, while 16 cases have been found in the foreign literature. The review of such reports is of interest because of the difficulty in diagnosis of vaccinial lesions in the nose which do not show the typical papulopustular appearance. It seems of particular interest during the present war emergency, which necessitates wholesale vaccination of many persons.

Kronenberg [1] reported the first case in 1896. A boy 8 years old had an old nasal eczema, which was associated with some itching. He acquired a superimposed infection after his brother had been vaccinated. Material from the nasal lesion produced a typical vaccinial lesion in the father's arm. Sadler [2] reported the case of infection of the mucosa of the nasal septum in a woman who had been caring for a vaccinated child. The case reported by Lublinski [3] is of interest since the accidental infection occurred in a woman suffering from nosebleed. She used a handkerchief previously employed as a bandage on a vaccinated child to control the flow of blood from the nose. Kidd [4] and Bowen [5] each reported cases in which the condition simulated acute erysipelas of the nose. In each case a lesion developed near the tip of the nose, and the infection then spread over the skin of the entire nose and face. The infections were obtained from a vaccinated child. Ramorino [6] described the case of a 5 year old boy who was accidentally vaccinated at the mucocutaneous border of the nose by contact with a recently vaccinated cousin. In 1924 Jamain [7] reported the case of a woman who had been bitten on the nose by a 5 month old infant who had previously been vaccinated. The woman's

From the Department of Ophthalmology, Columbia University College of Physicians and Surgeons, and the Institute of Ophthalmology, Presbyterian Hospital.

1. Kronenberg, E.: Ein Fall von Vaccineübertragung, Deutsche Med.-Ztg. **17**:283, 1896.

2. Sadler, E. A.: Two Cases of Accidental Vaccination, Birmingham M. Rev. **1**:390, 1903.

3. Lublinski, P.: Akzidentelle Vakzination der Nasenschleimhaut, München. med. Wchnschr. **51**:2328, 1904.

4. Kidd, W.: Accidental Vaccination of a Woman by Her Child, Lancet **1**:1906, 1900.

5. Bowen, W. H.: Accidental Vaccinia of the Nasal Cavity, Lancet **2**:20, 1904.

6. Ramorino, C.: Alcuni casi di vaccinodermia da contagia diretto, Policlinico (sez. prat.) **29**:1527, 1922.

7. Jamain, C.: Un cas de pustule vaccinale du nez, Ann. de dermat. et syph. **6**:463, 1925.

lesion followed a typical course. Two years later Läwen [8] published 2 cases in which the vaccinial lesion had spread over the entire nose. They occurred in women whose children had recently been vaccinated. In 1 case the patient's handkerchief had been used as a bandage for the child. Liveriero,[9] in 1929, reported 2 cases of women suffering from rhagades of the nasal vestibule who showed pustular lesions at the alae nasi and marked edema of the cheek and upper lip several days after their children had been vaccinated. The nasal cavities remained normal.

Seven years later, Weinhold [10] reported 2 cases. In the first case, that of a 23 year old woman, vaccinated twenty years previously, the lesion resembled primary syphilis. Three weeks after her child's vaccination she presented ragged and honeycombed crusts on the outer surfaces of the alae nasi, accompanied by widespread areas of edema, which were pale, dense and insensitive to pressure. The lesion healed within ten days without scar formation. Against the syphilitic origin was the history, the negative Wassermann reaction and the tenderness and mild swelling of the lymph nodes of the jaw. The second case was that of a 51 year old woman who had been vaccinated three times, the last time successfully twenty years before. Pustules appeared on the outer surface of her nose at the tip while she was attending a child vaccinated three weeks previously. The pustules were surrounded by redness and edema, suggestive of erysipelas. The lesion healed with slight scar formation. Pustular material at the tenth day of the disease, injected into the patient's own thigh, did not give a positive reaction.

Bedford and Hellier,[11] in 1938, reported a case of accidental vaccination in the nose of a 31 year old woman suffering from fissures at the corner of the nose. The infection occurred five days after a dressing had been removed from the arm of her vaccinated child. Vesicles developed in the nose and were associated with swelling, edema, pain and large, painful cervical lymph nodes. The patient had never been vaccinated, and the diagnosis at admission (ten days after onset of symptoms) was that of anthrax. The nose appeared bulbous at the tip and crusted, but at the margin of the ulcerated area variola-like pustules appeared, which were also present on the right cheek. The patient eventually recovered, with some scar formation. The diagnosis of malignant pustule was excluded by absence of a central black slough. The acuteness and rapidity of the onset made a diagnosis of primary syphilis unlikely. Despite unsuccessful attempts at rabbit passage, a diagnosis of accidental vaccination was suggested on the basis of the anamnesis and the clinical course of the disease.

In 1939 Giuffrida [12] described the case of a 16 year old boy who showed fibrinous ulceromembranous rhinitis of the right nasal fossa with regional adenitis and a temperature of 40 C. (104 F.). He had been

8. Läwen, A.: Vakzinübertragung vom Kind auf Mutter, München. med. Wchnschr. **73**:1504, 1926.

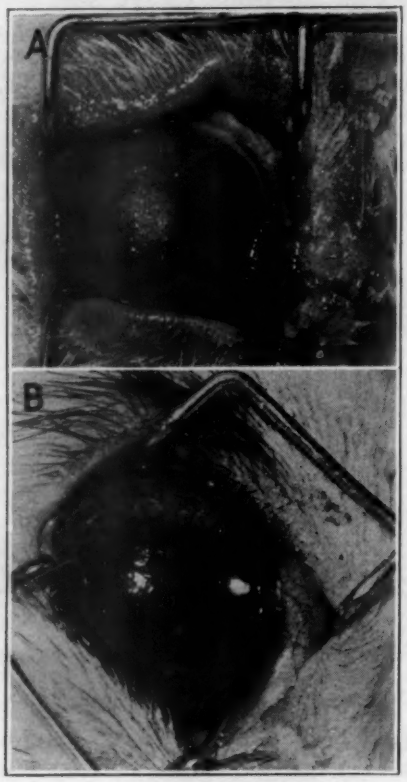
9. Liveriero, E.: Di due casi di autovaccinazione nasale col vaccino antivaioloso, Ann. di laring., otol. **30**:149, 1929.

10. Weinhold, K.: Impfinfekte an der Nase nach Kuhpockenimpfung, Arch. f. Ohren-, Nasen- u. Kehlkopfh. **142**:208, 1936.

11. Bedford, M., and Hellier, V.: Accidental Vaccination of the Nose: Case, Brit. M. J. **2**:991, 1938.

12. Giuffrida, E.: Raro caso di rinite vaccinica, Minerva med. **1**:249, 1939.

caring for his 4 year old brother, who had been vaccinated a few days before. He had no recollection of any nasal abrasion previous to this disease. The case was tentatively diagnosed as one of nasal diphtheria, but Löffler's bacilli were not recovered, although staphylococci and streptococci were cultured in small numbers from material from the lesion. The septic symptoms were ascribed to vaccinia virus, since typical vaccinial pustules appeared in the left zygomatic region. In contrast to the severe initial symptoms, the course of the disease was mild.



A, cornea of a nonimmunized rabbit inoculated with scrapings from a vaccinial lesion of the nose, showing severe keratitis and conjunctivitis; *B*, cornea of an immunized rabbit similarly treated, which remained normal.

The patient was discharged after a few days with a diagnosis of vaccinial rhinitis.

The same year, Cowdane and Boron [13] reported the case of a 6 year old child who had been successfully vaccinated at the age of 1 year. A few days after his sister's vaccination, the child showed edema of the

13. Cowdane, A., and Boron, R.: Inoculation intra-nasale accidentelle de vaccine jennérienne, Soc. de méd. mil. franç., Bull. mens. **33**:62, 1939.

face and neck, with complete obstruction of the nasal orifices, which were plugged with crusts. Typical pustules were present on the cheeks. The child had no fever and recovered in a few days.

REPORT OF CASE

C. A., a white man aged 32, a research worker, had been vaccinated against variola in 1915, 1918 and 1925. In December 1941, four days after having inoculated several rabbits with vaccinia virus, the patient noted a superficial, slightly tender, membranous ulcer, measuring approximately 5 by 5 mm., in the subseptal region of the right nostril, accompanied by mild symptoms of general malaise. The lesion healed in a few days, leaving a scar measuring 2 by 1 mm.

One physician diagnosed the nasal ulcer as herpes; however, we suspected accidental vaccination. Scrapings from the lesion were smeared for microscopic examination and rubbed on the scarified corneas of a nonimmunized rabbit and a rabbit which had previously been immunized to vaccinia virus. No Guarnieri bodies were seen in the direct smear of material from the nose. In the cornea of the nonimmunized rabbit marked keratitis and severe conjunctivitis developed (fig. 1 *A*). Corneal scrapings stained by Giemsa's method showed Guarnieri bodies. The cornea of the immune rabbit remained normal (fig. 1 *B*), thus indicating the presence of the vaccinial virus, as proved by the Paul test.[14]

COMMENT AND CONCLUSION

Reports of accidental infection with vaccinia usually are concerned with the eyes, probably because of the impending danger of blindness. In 1904, Blochmann [15] collected 141 cases of accidental vaccination from the literature, in 61 of which the lesions were ocular. A mucocutaneous or cutaneoconjunctival border (Perera [16]) is involved in most cases.

The diagnosis of a vaccinial origin in the previous cases of nasal infection was based chiefly on the history of recent vaccination in the family. The course of the disease was mild in all instances except in the case reported by Bedford and Hellier, in which the woman had not been vaccinated. In the present case, a laboratory infection with vaccinia, as proved by the Paul test, showed the clinical feature of a superficial, slightly tender, membranous ulcer and ran the course of an accelerated vaccinial reaction.

The factors preventing the typical appearance of the vaccinial lesion in the nose may be the anatomic structure of the organ and its exposure to mechanical insults. Local and general reactions are usually mild, due to the presence of some degree of immunity in the patient.

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14. Paul, G.: Eine neue Untersuchungsmethode der variolierten Hornhaut des Kaninchenauges zur objektiven Sicherung der Varioladiagnose, Wien. klin. Wchnschr. **29**:996, 1916.

15. Blochmann, F.: Ist die Schutzpockenimpfung mit allen notwendigen Kautelen umgeben? Entörtert an einem mit Verlust des einen Auges verbundenen Falle von Vaccineübertragung, Tübingen, F. Pietzker, 1904.

16. Perera, C. A.: Vaccinial Disciform Keratitis Following Accidental Inoculation of the Eyelids, Arch. Ophth. **24**:352 (Aug.) 1940.

HERPES ZOSTER OTICUS

MAURICE F. STOCK, M.D.,* LOS ANGELES

Herpes zoster oticus is rarely encountered. This case is believed to be of special interest since the condition widely involved the fifth, seventh and eighth cranial nerves.

REPORT OF A CASE

Mrs. E. H. A., aged 57, was first seen by me on Feb. 9, 1942, ten days after the onset of her illness. Her initial symptom had been a severe, intermittent, "shooting," right-sided occipital headache, beginning on January 31. On the seventh day of her illness there was a burning pain in the lobule of the right ear, the right half of the tongue and the right half of the soft palate. This was followed, on the eighth day, by a herpetic eruption of the right ear, which began on the lobule and spread over the entire lateral surface of the auricle. At the same time there developed a herpetic eruption over the right half of the soft palate and tongue. On the tenth day of the illness the patient had vertigo, nausea and vomiting, nystagmus and paralysis of the right side of the face. Vertigo was absent if the patient remained flat on her back in bed, but became violent on the least movement of her head.

On the tenth day the patient was hospitalized, and examination at that time revealed a herpetic eruption of the lateral surface of the right auricle, the right half of the soft palate and tongue and the entire right nasal chamber. There were complete paralysis of the right side of the face and a third degree spontaneous rotatory nystagmus, with the fast component to the left. Hearing was grossly normal when tested with the spoken and the whispered voice. The vertigo abated gradually during the eleventh and twelfth days, and on the thirteenth day the patient was able to be up and about with assistance. On the fourteenth day tinnitus and deafness developed in the right ear. The spoken voice was heard at a distance of 2 feet (60 cm.) and the whispered voice not at all. The third degree nystagmus continued, but the sensation of vertigo continued to improve. On the fourteenth day the patient was discharged from the hospital and subsequently was seen in the office.

The tongue, the soft palate and the nasal mucosa were healed by the nineteenth day. The nystagmus and vertigo were improved, but the deafness and facial paralysis were unchanged. On the twenty-fifth day the skin on the ear was almost completely healed. A third degree nystagmus to the left was still present. The recommended tests for taste were performed on the twenty-eighth day and taste seemed normal. In the Romberg test the patient swayed to the left. On the thirty-sixth day she complained that all sounds caused a rattle in the right ear. Hearing had improved, as the spoken voice was heard at 5 feet (152 cm.) and the whispered voice at 8 inches (20 cm.) and it was found that the tinnitus had diminished.

It was felt that the rattling induced in the ear by all perceptible sounds was due to paralysis of the stapedius muscle, which had been rendered obvious by the improvement in hearing. On the fiftieth day the nystagmus was of the second

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degree, with the fast component still to the left. All perceptible sounds still caused a rattling in the right ear. The spoken voice was heard at 5 feet and the whispered voice at 8 inches. The tinnitus was found to be diminishing. Tuning fork tests showed nerve deafness.

On the sixty-third day there was only a first degree nystagmus, and the tinnitus was steadily diminishing. The spoken voice was heard at 5 feet. On the seventy-first day, the date of the last examination, there was no nystagmus and the spoken voice was heard in the right ear at a distance of 30 feet (9 meters) and a whisper at 10 feet (3 meters). There was no tinnitus, but sounds still caused a slight rattling. The Romberg sign at this time was not present. Caloric tests produced no reaction in the right semicircular canals and a normal reaction in the left semicircular canals. The facial paralysis was still complete.

Treatment since the tenth day of illness included administration of thiamine hydrochloride and vitamin B complex and galvanic muscle stimulation.

COMMENT

Regeneration of the facial nerve is still hoped for. The great improvement in hearing is unusual.

A study of the literature indicates that the deafness is usually permanent.

Herpes zoster oticus of such wide extent is indeed rare.

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THROMBOSIS OF CAVERNOUS SINUS IN PRESENCE OF PITUITARY ADENOMA

Report of a Case with Recovery

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The concomitant presence of pituitary adenoma with acute thrombosis of the cavernous sinus is uncommon. A review of the literature discloses but few cases of recovery from thrombosis of the cavernous sinus. Barnshaw [1] and Seydell [2] each reported such a case. Since the advent of chemotherapy, however, the number of cases of recovery has increased. Morrison and Schindler,[3] the Wolfes [4] and Lyons [5] reported recoveries in 4 cases of thrombosis of the cavernous sinus through chemotherapeutic means. In the case of Morrison and Schindler treatment was with sulfapyridine (2-[paraaminobenzenesulfonamido]-pyridine), and in the 2 cases of Lyons a combination of heparin, sulfapyridine and, later, sulfathiazole (2-[paraaminobenzenesulfonamido]-thiazole) was employed. In the case reported by the Wolfes and in our case sulfathiazole alone was used. The rare occurrence of recovery with sulfathiazole therapy warrants the report of this case.

REPORT OF CASE

L. R., aged 36, white, was admitted to the Lutheran Hospital, Brooklyn, at 5 a. m. July 25, 1940, in a state of delirium. He complained of severe pains in the back of the head and over both eyes, inability to raise his left upper eyelid and fever.

His general health was said to have been good during the year prior to his admission to the hospital except for frequent "head colds" and "sinus trouble." Because of this he consulted a nose and throat specialist, who treated him for six weeks by means of sprays and tampons. The patient complained of frontal and occipital headache, but no roentgenographic studies of the skull or sinuses were made, nor were any instruments used during the therapy. He felt slightly improved as a result of this treatment and left on his vacation on July 20. Two days after arriving in the country he became acutely ill with what he considered "a head cold." This was ushered in with chills and fever. A physician was called, and a diagnosis of grip due to "sinus trouble" was made. The next day his wife noticed narrowing of his left eye. His temperature rose to 103 F., and he looked worse. The

1. Barnshaw, H. B.: Report of a Case of Bilateral Cavernous Sinus Thrombosis: Recovery Without Operative Intervention, J. M. Soc. New Jersey **36**:22 (Jan.) 1939.

2. Seydell, E. M.: Recovery from Thrombosis of Cavernous Sinus, Arch. Otolaryng. **30**:429 (Sept.) 1939.

3. Morrison, L. F., and Schindler, M.: Cavernous Sinus Thrombosis: Report of Recovery Following Sulfapyridine Therapy, Arch. Otolaryng. **31**:948 (June) 1940.

4. Wolfe, C. T., and Wolfe, W. C.: Thrombosis of Cavernous Sinus with Recovery, Arch. Otolaryng. **33**:81 (Jan.) 1941.

5. Lyons, C.: The Treatment of Staphylococcal Cavernous Sinus Thrombophlebitis with Heparin and Chemotherapy, Ann. Surg. **113**:113 (Jan.) 1941.

physician still thought that he had grip. On the second day of his illness his temperature rose to 105 F., and he became delirious. Two consultants were called, and his wife decided to remove him by ambulance to Brooklyn.

Past and Family Histories.—He had had measles and chickenpox during childhood and pneumonia at the age of 19. His past surgical history was entirely without significance. His habits presented nothing of note. A detailed history of the various systems revealed nothing of importance except for the occurrence of the "head colds" and "sinus trouble" previously mentioned.

The family history was noncontributory.

Physical Examination.—The patient was acutely ill, with delirium and complete clouding of the sensorium. He talked incessantly and held his left hand over his forehead, as if in pain. His temperature was 105 F., his pulse was regular and of good volume, with a rate of 122 per minute, and the respiratory rate was 24. He

Roentgenogram of pituitary region, showing extensive destruction of the floor of the sella turcica and partial destruction of the posterior clinoid processes.

was flushed, and his skin was dry and hot. His lips were not cyanotic. His tongue was clean and dry, and no abnormal odors could be detected on his breath.

The patient was 6 feet 2 inches (187.9 cm.) in height and weighed 204 pounds (92.5 Kg.). He had large hands and feet, and there was some degree of prognathism. He was somewhat obese.

The general medical examination revealed essentially a normal condition except that he was of definite hyperpituitary type.

Neurologic Examination.—The patient was excitable and restless. He did not cooperate well in examination but appeared to have normal strength in both arms and legs. There was no evidence of paresis or paralysis. Coordination tests could not be performed. Reflexes were diminished in both upper and lower extremities. No ankle clonus was noted. No abnormal phenomena, such as the Hoffmann or the Babinski sign or its confirmatory reflexes, were present. There was slight rigidity of the neck.

The results of sensory examination were difficult to evaluate because of the patient's delirium. However, he reacted to painful stimuli, except over the left

upper part of the face. Examination of the cranial nerves showed ptosis of the left eyelid, with proptosis and fixation of the left eyeball. The left eyeball could not be moved upward, downward or inward, but external rotation was normal. The left pupil was round, regular and dilated and did not react to light, directly or consensually, or in accommodation. The right eyeball and pupil were normal, and no extraocular palsies were noted. The fundi were normal. The patient did not respond to pressure over the left supraorbital nerve, whereas he seemed to be hypersensitive to pressure over the right nerve. No other signs of involvement of the cranial nerves were noted. Although he was disoriented as to time and place, his attention could be maintained for very brief periods.

Consultation on the Ear, Nose and Throat.—The nasal mucosa was much congested and thickened; the middle turbinates were swollen, and a mucopurulent postnasal drip, with redness of the pharyngeal mucosa, was present. The diagnosis was pansinusitis.

Laboratory Examination.—Urinalysis gave normal results on two occasions. The first blood count showed 3,710,000 red cells, 53 per cent hemoglobin and 20,450 white cells, of which 94 per cent were polymorphonuclears and 6 per cent lymphocytes. A second blood count, twenty-four hours later, revealed 5,380,000 red cells, 78 per cent hemoglobin and 14,900 white cells, of which 81 per cent were polymorphonuclears, 13 per cent lymphocytes and 6 per cent large mononuclear cells. Chemical studies of the blood on admission showed 154.2 mg. of sugar, 26.8 mg. of nonprotein nitrogen and 1.30 mg. of creatinine per hundred cubic centimeters. The Wassermann reaction of the blood was negative. The blood culture showed no growth after twenty-four hours, forty-eight hours, five days and ten days. The spinal fluid contained 307 white cells per cubic millimeter and many red blood cells; it reduced sugar, and a smear showed a few pus cells but no bacteria. Culture of the spinal fluid yielded no growth. Throughout therapy the sulfathiazole level was maintained between 5 and 8 mg. per hundred cubic centimeters of blood.

Roentgenographic Studies.—The nasal margin of the superior orbital rim on the left side appeared thinned. The left orbit and frontal sinus were denser than the right. The ethmoid and sphenoid sinuses appeared cloudy. The antrums were well aerated. The nasal septum deviated to the left, with apparent obstruction of the left nasal passage. There was some mottling in the region of the anterior fossa suggestive of increased intracranial pressure. Lateral roentgenograms of the skull showed marked destruction of the floor of the sella turcica with partial destruction of the posterior clinoid processes, distortion of the clinoid processes and atypical calcium deposits above the dorsum sellae, all characteristic of a pituitary tumor which has extended into the middle cranial fossa.

The roentgenographic diagnosis was pansinusitis and pituitary tumor.

Treatment.—Because of the acute onset and rapid progression of symptoms and signs, the prognosis was poor. Since neurosurgical intervention was not indicated, it was deemed advisable to use chemotherapy. Sulfathiazole was chosen, and the patient was given 60 grains (3.9 Gm.) as the first dose and 30 grains (1.85 Gm.) every three hours thereafter, all by the rectal route. A total of 640 grains (41.6 Gm.) was given over a period of seventy-two hours. The drug was well tolerated. There was no jaundice or other adverse effect on the liver, the kidneys or the hematopoietic system.

Course.—The patient's temperature returned to normal three days after the administration of sulfathiazole and stayed so until his discharge on the tenth day. With this return to normal, the sensorium cleared and the rigidity of the neck

disappeared. He was relieved of his headache, but the condition of his eyes remained unchanged.

We have examined the patient at monthly intervals since his discharge from the hospital. The ptosis and proptosis of the left eye gradually cleared over the next five months, and the left pupil reacted to light for the first time seven months after discharge. At present the patient is gainfully employed and is free from symptoms, with normal neurologic signs. Roentgenograms of the pituitary area taken in January and June 1941 showed no progress over those taken in July 1940.

COMMENT

The diagnosis of thrombosis of the cavernous sinus was made after consideration of the history, the progression of the disease and the physical findings. The proptosis and fixation of the left eyeball, the dilatation of the left pupil, the ptosis of the left eyelid and the failure of the pupil to react to light or in accommodation pointed to a lesion of the third cranial nerve. The acute onset, with chills, fever, rapid prostration and delirium, indicated that the lesion involving the third nerve was of inflammatory character. The history and roentgenographic evidence of sinus infection and the laboratory findings also pointed to the infectious nature of this condition. The disparity between the first and the second blood count was such as to lead us to believe that the first red cell count and hemoglobin determination were probably incorrect. Meningeal irritation was evidenced by the presence of white blood cells in the spinal fluid. We do not believe that there was septicemia, in view of the absence of an enlarged spleen, and petechiae and the repeated sterile blood cultures. The absence of chemosis may be explained by the spread of infection via the middle route, namely, from the sphenoid sinus. The condition was distinguished from orbital cellulitis, which seldom or never causes ocular paralyses or interferes with pupillary reaction. The same can be said for uncomplicated frontal sinusitis. The exophthalmos from an arteriovenous aneurysm generally follows injury and is pulsating.

The roentgenographic report of a pituitary tumor was not expected, and since there had been relatively little impairment of the visual fields, we consider that the neoplasm had eroded through the sella, thus decompressing itself, a long time prior to the onset of the patient's illness. We feel, therefore, that the acuteness of the symptoms and the presence of infection rule out the possibility that the neoplasm may have produced the symptoms. This opinion is further substantiated by the progressive improvement in the physical signs which the patient has shown since his discharge. The future course of this patient, in view of the presence of a pituitary tumor, makes the ultimate prognosis guarded.

SUMMARY

A case of thrombosis of the cavernous sinus in the presence of pituitary adenoma with recovery is presented. A review of the literature demonstrates that chemotherapy has been used successfully in very few cases. This case is unusual in that a pituitary tumor of long standing, previously asymptomatic, was discovered during the examination.

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Progress in Otolaryngology

Summaries of the Bibliographic Material Available in the Field of Otolaryngology

TUMORS OF THE NOSE AND THROAT

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One of the most serious problems in the care of malignant tumors of the upper parts of the respiratory and digestive tracts is that of the treatment of metastatic involvement of the cervical lymph nodes. As a substitute for block dissection of the cervical lymph nodes, Martin [1] has devised a method of irradiating the lymph nodes of the neck. The intention in this technic is to employ doses large enough to eradicate any cancer cells present in lymph nodes. Briefly, the method is that of inserting platinum radium needles, weak and heavily filtered, into the lymph nodes through small cutaneous incisions. In addition, supplementary external roentgen radiation is employed. The author discusses in detail 6 cases in which this technic was employed. Satisfactory resolution of the cervical involvement was obtained in 24 of 39 unselected cases of cancer of the lip and mouth. The 24 patients are living and have been symptom free for periods varying from one to seven years. Martin stresses that in several of these cases the condition was considered hopeless from a surgical standpoint.

In an effort to consider most of the cancers affecting the maxillofacial region, nose, pharynx and larynx, Cantril [2] presents a very brief description of the symptoms, the physical findings and the treatment of such growths. A case of nasopharyngeal cancer is considered. It is the author's opinion that no tumor of a lymph node should be removed without a definite effort having been made to find a primary tumor.

From the Section on Laryngology, Oral and Plastic Surgery of the Mayo Clinic.

1. Martin, C. L.: Treatment of Metastatic Cervical Lymph Nodes with Irradiation: A New Method, Tr. Sect. Laryng., Otol. & Rhin., A. M. A., 1940, pp. 86-108.

2. Cantril, S. T.: Malignant Tumors of the Head and Neck: Problems in Diagnosis, Northwest Med. **39**:444-447 (Dec.) 1940.

In reference to biopsy of cervical lymph nodes he believes that only small accessible lymph nodes should be removed and discourages excision of a small portion of a node or attempted complete removal of large nodes.

Woodward and Archer [3] analyze in tables the results of their treatment of cancers of the larynx, hypopharynx, nasopharynx and accessory sinuses. Their conclusions as to the best methods of treating such lesions are outlined as follows: 1. Intrinsic cancer of the larynx should be treated surgically. 2. Extrinsic cancer of the larynx should be treated by preliminary laryngectomy (cervical extension being disregarded) followed by roentgen irradiation of the involved regions. 3. Cancer of the hypopharynx is best treated by a combination of methods, the use of roentgen rays being relied on chiefly, but with local excision or radon implantation or both being employed as a preliminary step in certain cases. 4. Cancers of the nasopharynx are best treated by means of roentgen radiation with occasional ligation of the carotid vessels, local excision and/or implantation of radon as a preliminary step. 5. Transitional cell carcinoma of the accessory sinuses may well be treated with roentgen rays, but the eye on the same side must be sacrificed since, in order to prevent early metastatic involvement of the brain, the region treated must reach to the base of the skull. 6. Epidermoid carcinoma of the sinuses is best treated surgically, with dependence perhaps on roentgen radiation to cope with metastatic involvement of the cervical lymph nodes, especially in cases in which the carcinoma is highly malignant, and on block dissection in the other cases.

Arons [4] discusses neoplasms of the maxillary antrum, nasopharynx and hard palate and presents 4 case histories to illustrate the problems involved. Since radical operation for cancer of the antrum usually is of little benefit, Arons asserts that the treatment of choice is a combination of operation and irradiation. For nasal cancer the use of a radium applicator over the lesion and external radiation is recommended. The author voices the following opinions: Fibroma of the nasopharynx should be treated conservatively with a view to relieving pressure symptoms since growths of this type tend to regress spontaneously. A well encapsulated mixed tumor of the palate is best removed by excision; but if it is malignant and still operable, preoperative irradiation, excision and postoperative irradiation constitute the treatment of choice. If a palatal tumor is inoperable, it must be irradiated both with roentgen rays and with radium.

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3. Woodward, F. D., and Archer, V. W.: The Results of Treatment of Malignant Tumors of the Larynx, Hypopharynx, Nasopharynx, and Sinuses, Virginia M. Monthly **67**:751-755 (Dec.) 1940.

4. Arons, I.: Neoplasms of the Antrum, Nasopharynx, and Hard Palate, Laryngoscope **51**:61-76 (Jan.) 1941.

TUMORS OF THE NOSE AND ACCESSORY SINUSES

Rawlins [5] reports a case in which osteoma of a maxillary sinus followed extraction of teeth. He is inclined to believe that traumatic irritation was a possible etiologic factor. He states that the microscopic picture of the tumor in this case supported Fetissof's idea that such a tumor develops from inside outward by metaplasia of the fibrous tissue into osseous tissue.

TUMORS OF THE LIPS AND MOUTH

Benign and malignant tumors affecting the upper and lower lips are considered by Simpson.[6] His article consists of a general consideration of the diagnosis and treatment of such neoplasms and brings out the fact that in 98 per cent of cases of cancer of the lip the lesion occurs on the lower lip. Metastasis of squamous cell carcinoma of the lip is described, particularly in reference to the grade of activity of the primary lesion. The author recommends biopsy in most cases of cancer of the lip but feels that a clinical diagnosis of a very small lesion is sufficient without a microscopic examination. While either operation or radium treatment is considered efficient for low grade squamous cell carcinoma, the use of radium alone is recommended for high grade squamous cell epithelioma, basal cell cancer and adenocarcinoma. The author's method of treating these cancers by surface application of radium is presented.

Jones [7] considers precancerous and cancerous lesions of the lip, and quotes statistics from other authors. As to treatment, he states that it makes little difference whether the primary lesion of the lip is controlled by operation, irradiation or electrocoagulation if the growth is completely eradicated. However, he is convinced that advanced primary cancers are best treated by operation. He disapproves of bilateral block dissection of the neck, maintaining that there is 11 per cent mortality even in the hands of a skilled surgeon. Unilateral cervical dissection is considered not only to be much safer but also to give rise to fewer complications.

In considering treatment of cancer of the lip, Johnson [8] recommends surgical excision if the lesion is small or of moderate size. He has given up the V type of excision. For a large cancer of the lip, he advocates roentgen therapy. As to cervical metastasis he recommends cervical dissection when there are no palpable lymph nodes and also when there

5. Rawlins, A. G.: Osteoma of the Maxillary Sinus: Report of a Case, Arch. Otolaryng. **32**:499-505 (Sept.) 1940.

6. Simpson, F. E.: Cancerous and Precancerous Lesions of the Lip, Illinois M. J. **79**:459-464 (June) 1941.

7. Jones, G. W.: Tumors of the Lip, Southwest Med. **24**:188-190 (June) 1940.

8. Johnson, G. S.: The Treatment of Carcinoma of the Lip, J. Tennessee M. A. **33**:268-271 (July) 1940.

are palpable lymph nodes if these are mobile and operable. If the lymph nodes cannot be removed, he recommends roentgen therapy. Six cases of cancer of the lip are presented; all of the patients were living up to six years after operation.

Together with a general consideration of cancer of the lower lip, 4 case histories are presented by Levin.[9] He recommends operation followed by radium therapy. In case the tumor is so extensive as to become adherent to the bone he recommends radium therapy alone and advises that the radon seeds or radium needles be inserted into the lip and into the involved lymph nodes.

Various aspects of the treatment of cancer of the lip are considered in a lengthy and detailed article by Blair and Byars.[10] Particular emphasis is placed on the problem of dealing with cervical metastasis.

In connection with the surgical treatment to be followed in cases of large cancer of the lower lip, Federspiel [11] describes a plastic operation in which the entire lower lip was removed. This operation was performed in two stages, with flaps from the adjacent portions of the cheeks being used in the reconstruction of the lower lip.

According to Hunt,[12] any "crack," "fever blister" or unexplained "sore" which does not heal within four weeks, especially if on the lower lip of a man, must be considered cancer until proved not to be by biopsy. He states further that the incidence of cancer of the lip can be reduced by (*a*) protection against sunburn, (*b*) avoidance of burns by short cigarets and hot pipes, (*c*) relief from irritation by sharp, jagged or overhanging teeth and (*d*) eradication of leukoplakia and papillomatous growths. In general he advocates radiotherapy because of its simplicity, the better cosmetic result and less interference with function. However, for ulcerating cancer, destructive cancer and the rare radioresistant cancer he advises resection and plastic repair. He considers that there are prospects of a "five year cure" in 90 to 95 per cent of the cases in which there is no apparent metastasis, in 33.3 per cent of those in which there is an early single focus of metastasis in the suprahyoid structures and in only 1 per cent of those in which there is metastatic involvement of the cervical lymph nodes.

9. Levin, I.: Surgical and Radium Therapy in Carcinoma of the Lip, Mississippi Valley M. J. **63**:47-50 (March) 1941.

10. Blair, V. P., and Byars, L. T.: Current Treatment of Cancer of the Lip: A Clinical Speculation, Surgery **8**:340-352 (Aug.) 1940.

11. Federspiel, M. N.: Extensive Plastic Repair for Restoration of the Lower Lip: Report of Procedure in a Case in Which the Lower Lip Was Entirely Removed for the Eradication of an Epithelioma, Wisconsin M. J. **40**:289-291 (April) 1941.

12. Hunt, H. B.: Cancer of the Lip: A Consideration of Its Prophylaxis, Diagnosis and Treatment, Am. J. Orthodontics **26**:1181-1194 (Dec.) 1940.

Precancerous lesions of the lip and mouth are considered by Pfahler.[13] He states that cancer of the lip could be prevented in almost all cases by treating precancerous lesions properly. Leukoplakia, papillomas, erosions, ulcerations, irritations or indurations should be destroyed as soon as noted, as a preventive of cancer. Electrodesiccation is advanced as a valuable treatment of these precancerous conditions. In the treatment of cancer of the lip and mouth he favors the use of radium. He does not believe in routine block dissection of the cervical lymph nodes for early cancer of the lip and says that with the prophylactic use of radiation he has been able to obtain cures without such dissection in 98 per cent of cases. He also recommends the use of external radiation rather than block dissection for cancer of the mouth. For differentiated carcinoma he advises the use of radium for four to six days. It is his practice to give about half of the surface application of radiation before inserting radium needles into the lesion and to give the other half after the insertion of the radium needles.

Figi [14] describes the various types of cancers involving lips and cheeks and states that three fourths of labial cancers are of grade 1 or 2. He recommends excision of cancer of the lip with immediate plastic reconstruction if there is no attachment of the growth to the mandible. Should the cancer be active, involving one or both cheeks, or should it be attached to the mandible, wide excision with a cautery knife or destruction by electrocoagulation, with the wound being left wide open, is thought advisable. It is his experience, he states, that in 90 per cent of the cases in which there is no involvement of the lymph nodes the patient remains well for five years or more. Well localized malignant tumors of the cheeks have been excised by him while those of more extensive dimensions have been subjected to wide electrocoagulation. Dissection of the cervical lymph nodes is recommended in all cases of cancer of the lips and cheeks unless the local involvement is extremely inactive.

Marshall [15] reports a case of sublingual epidermoid cyst in a man aged 48 years. Before coming under the author's care, the patient had had several incisions in the submental region for drainage of the cyst. Roentgenograms of the tumor were then taken by injecting iodized poppyseed oil into the cystic cavity. The growth was removed surgically, with the patient under cervical paravertebral block anesthesia.

In a very general consideration of cancer of the mouth Pfahler [16] stresses the fact that cancer of the oral cavity can be prevented by keeping

13. Pfahler, G. E.: Treatment of Cancer of the Lip and Mouth, Radiology **35**:598-605 (Nov.) 1940.

14. Figi, F. A.: Cancer of the Lips and Cheeks, Proc. Staff Meet., Mayo Clin. **16**:73-75 (Jan. 29) 1941.

15. Marshall, L. R.: Sublingual Epidermoid Cysts, Arch. Otolaryng. **33**:659-662 (April) 1941.

16. Pfahler, G. E.: Cancer of the Mouth: Its Prevention and Early Diagnosis, Bull. Am. Soc. Control Cancer **22**:5-7 (Dec.) 1940.

every part of the oral mucous membrane in a healthy condition. He believes that cancer of the mouth could be prevented in nearly all instances and could be cured in at least 75 per cent of the cases if all the knowledge now available were utilized by all people, including members of the medical profession.

Solomon and Burke [17] point out that malocclusion and alveolar resorption, as well as ill fitting or poorly made dental appliances, often cause benign or malignant oral tumors. They recommend the correction of such etiologic factors as an aid in the prevention of neoplasms of the mouth.

Jacobs [18] describes briefly the more common types of precancerous lesions and cancers affecting the oral cavity. Included in his consideration are mixed cell tumors involving the salivary glands, palate and buccal mucosa. It is his opinion that there are three accepted methods of treating cancers of the oral cavity: first, irradiation of the involved regions with roentgen rays or radium; second, irradiation followed by operation; third, operation followed by irradiation. Eight cases are reported.

In a general consideration of the objective findings in cases of malignant oral tumors Nelson [19] stresses the importance of biopsy to insure a conclusive diagnosis.

The following measures are considered by Hollander, Shelton and Shonfield [20] as important in the treatment of carcinoma of the mouth: The use of tobacco and hot foods, the chewing of rough substances and the wearing of artificial dentures are prohibited; oral sepsis is reduced, and general oral hygiene is introduced. The authors believe in the refrigeration treatment of carcinoma; the patient is instructed to keep ice cubes against the lesion during the entire day except at meal time for several days. Finally, they recommend the application of roentgen rays both to the local lesion and to the involved lymph nodes in the neck. Because they believe a statistical study is of questionable value, they do not quote any figures as to the results of the treatment which they recommend.

Friedell and Rosenthal [21] review 8 cases in which the tumors were treated with radiation, the purpose of the paper being to show the etio-

17. Solomon, H. A., and Burke, E. M.: Malocclusion and Alveolar Resorption as Etiologic Factors in Oral Tumors, J. Am. Dent. A. **28**:3-7 (Jan.) 1941.

18. Jacobs, M. H.: Malignancies of the Oral Cavity, Am. J. Orthodontics **27**:253-263 (May) 1941.

19. Nelson, P. A.: Early Diagnosis of Intra-Oral Cancer, J. Am. Dent. A. **27**:1644-1647 (Oct.) 1940.

20. Hollander, L.; Shelton, J. M., and Shonfield, L.: Intra-Oral Carcinoma: Practical Considerations in Regard to Diagnosis and Treatment, J. Am. Dent. A. **28**:572-580 (April) 1941.

21. Friedell, H. L., and Rosenthal, L. M.: The Etiologic Role of Chewing Tobacco in Cancer of the Mouth: Report of Eight Cases Treated with Radiation, J. A. M. A. **116**:2130-2135 (May 10) 1941.

logic relationship between tobacco chewing and cancer of the mouth. The effectiveness of the treatment was not considered. The cases were collected only during a two year period. However, the authors hold that the data support the theory that chewing tobacco is an etiologic factor in the development of cancer of the mouth and they give the following description of oral cancers which were undoubtedly produced by chewing tobacco:

> The lesions on the inner surface of the cheek associated with the use of chewing tobacco have a distinctive appearance. They are of a papillary verrucoid character, covered and surrounded by patchy areas of leukoplakia. Only moderate induration is present, and deep infiltration into the submucosal tissues is lacking. The leukoplakic changes are probably precursors of the actual neoplasm and represent the earliest changes. This is well illustrated in 2 subjects who transferred the quid from one side of the mouth to the other after the developing lesions became too painful. In both instances, small circumscribed patches of leukoplakia appeared at the new sites.

Martin and Sugarbaker [22] analyze 103 unselected consecutive cases of cancer of the floor of the mouth. All stages of the disease were observed. The patients were admitted to the hospital in the years 1930 to 1934. The etiology, clinical course, method of treatment, end results and prognosis are described in detail. Early growths, not over 1 cm. in diameter, are considered fit for surgical removal. Larger growths, from the practical standpoint, are believed to be inoperable except by resection of the anterior parts of both the tongue and the mandible. For such lesions the authors recommend radiation. They state that the treatment of a cancer of the floor of the mouth with radiation is so far superior to surgical removal that the latter does not merit detailed consideration. Peroral irradiation of the involved region with roentgen rays sometimes supplemented by implantation of radon seeds is advocated; the roentgen therapy is fractional. The use of roentgen radiation is advised for cervical metastasis; dissection of the cervical lymph nodes has been considered only in isolated cases in which metastasis first appeared after complete healing of the primary lesion. The net five year survival rate in their series of cases was 25 per cent.

The various types of cancers involving the jaws, including squamous cell epithelioma, adenocarcinoma, sarcoma and adamantinoma, are described by Erich.[23] The differential diagnosis of these types is considered. In the majority of cases the destruction of such lesions by surgical diathermy is recommended. However, in cases in which the grade of malignancy is high, this treatment is supplemented by the use

22. Martin, H. E., and Sugarbaker, E. L.: Cancer of the Floor of the Mouth, Surg., Gynec. & Obst. **71**:347-359 (Sept.) 1940.

23. Erich, J. B.: Cancer of the Jaws, Proc. Staff Meet., Mayo Clin. **16**:75-77 (Jan. 29) 1941.

of radon implants. Routine block dissection of the cervical lymph nodes is considered necessary in most cases of epithelioma of the lower jaw whether or not the lymph nodes of the neck are clinically involved. In cases of epithelioma of grade 4 and in cases of active sarcoma the external application of radiation to the neck may be preferable.

In considering cancer of the tongue, Havens [24] recommends excision in cases in which a small, well localized growth is found on the anterior portion of the tongue, particularly if it is not highly malignant. In cases in which the growth is situated farther posteriorly, as well as in those in which it is on the ventral aspect and involving the floor of the mouth, it is better treated by electrocoagulation and implantation of radium. A lesion too extensive for surgical removal should be treated with radium implants. The surgical removal of the regional lymph nodes in all cases in which the local lesion permits of surgical removal is advised.

A method of constructing from dental compound a double mold for holding and applying radium to the floor of the mouth and lower alveolus has been devised by Melville.[25] Tables showing the results of his treatment of malignant tumors in this region reveal that 61 per cent of the primary lesions healed and remained healed for three years and that in 46 per cent of the cases in which treatment was employed the patients were alive and free of disease three years after treatment. The author concludes that this method of treating carcinoma in the floor of the mouth is the method of choice.

Another method of making a mold into which capsules of radium can be inserted for the destruction of oral neoplasms is described by Levinson and Peck.[26] This procedure requires an impression of the alveolar ridges, from which a stone model is made. On the stone model is constructed a mold in which the capsules are inserted with proper spacing.

Duffy [27] presents a detailed account of the treatment of cervical lymph nodes in cases of intraoral cancer. He lists eight important factors as indications and eight as contraindications for performing dissection of these nodes. It is his opinion that suprahyoid dissection of the neck is inadequate and that radial dissection, including removal of the sternomastoid muscle and internal jugular vein together with block removal of the tissue of the cervical triangles, is the method of choice.

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24. Havens, F. Z.: Cancer of the Tongue, Proc. Staff Meet., Mayo Clin. **16**:72-73 (Jan. 29) 1941.

25. Melville, A. G. G.: Double Radium Mold Treatment of Carcinoma of the Floor of the Mouth and Lower Alveolus, Brit. J. Radiol. **13**:377-384 (Oct.) 1940.

26. Levinson, L. J., and Peck, N.: Application of Dental Molds to Radium Therapy, Am. J. Roentgenol. **44**:303-305 (Aug.) 1940.

27. Duffy, J. J.: Treatment of Cervical Nodes in Intra-Oral Cancer, Surg., Gynec. & Obst. **71**:664-671 (Nov.) 1940.

Baxter [28] collects from the literature reports of 54 cases of melanoma of the mouth. The most common sign of melanoma in the mouth is described as a rapidly growing "blackberry tumor." Hemorrhage, pain, loosening of the teeth, cervical metastasis, dysphagia, dyspnea, dysphonia and trismus may occur. He believes that the treatment of choice is wide removal of the growth by electrocoagulation. This should be followed by block dissection of the cervical lymph nodes. Before surgical treatment is considered, the possible presence of pulmonary or visceral metastasis is an important consideration. The author reports a case in which melanocarcinoma involved the alveolar tissue surrounding the upper incisor teeth in a man aged 42 years. Eighteen months after removal of the tumor by wide electrocoagulation there was no evidence of recurrence.

The use of zinc peroxide to control infections in primary oral neoplasms, in postoperative defects and in regions of radiation necrosis is the subject of an article by Sunderland and Binkley.[29] After the use of this compound they noted an improvement in the appearance of the lesion and subjective local and systemic improvement in the patient. They studied the use of this drug in 52 cases. The results of the treatment show that the drug uniformly controlled an anaerobic infection. Furthermore, it aided in the diminution of the offensive odor produced by the infection. In cases of secondary injury of a primary tumor the sloughing and the odor disappeared promptly after the use of zinc peroxide. While infection in regions of radiation necrosis did not respond as quickly as postoperative infection in nonirradiated tissue, it showed that zinc peroxide was of definite value.

TUMORS OF THE NASOPHARYNX

Sixty-three cases of juvenile basal fibroma of the nasopharynx observed at the Mayo Clinic were studied by Figi.[30] Fifty-eight of the patients were males, and 5 were females. The ages of the patients ranged from 10 to 31 years at the time of examination. The nasopharynx was involved in all the 45 cases studied in detail; the nasal fossae, in 34 cases. The maxillary antrum and the sphenoid and other accessory sinuses were invaded in a number of instances. The removal of tissue from these tumors was always attended by profuse bleeding. In some of the cases observed recently biopsy was not performed; the diagnosis

28. Baxter, H.: Review of Malignant Melanoma of the Mouth: Report of a Case, Am. J. Surg. **51**:379-386 (Feb.) 1941.

29. Sunderland, D. A., and Binkley, J. S.: Use of Zinc Peroxide in Infected Tumors and Radiation Necrosis: Report of Cases with Technic, Radiology **35**:606-615 (Nov.) 1940.

30. Figi, F. A.: Fibromas of the Nasopharynx, J. A. M. A. **115**:665-671 (Aug. 31) 1940.

was based on the history, the age of the patient, the hardness of the tumor and the characteristic clinical picture. It is suggested that the surgical removal of these tumors involves considerable risk and that recurrences are frequent. Implantation of radium and electrocoagulation supplemented with implantation of radium are described as the most effective forms of treatment. By electrocoagulation and insertion of radium a tumor of this type can at times be eradicated with a single treatment, but fewer complications are likely to be encountered if treatment is carried out in multiple stages. There was no mortality in this series of cases. All the patients who received a complete course of therapy were well, with the exception of a boy 16 years of age, who was still receiving treatment at the time the paper was written.

Walker and Stock [31] describe fibroma of the nasopharynx, which they state is firmly attached to the occipital and sphenoid bones. This growth occurs particularly during puberty and disappears when the patient reaches adult life. It is the authors' belief that the ossification between the sphenoid and occipital bones is completed by the age of 25 years and that the change in circulation at that time probably accounts for the fact that the fibroma sometimes shrinks away after the patient reaches this age. The difficulty in treating tumors of this type is ascribed to their extreme vascularity. The authors urge splitting the soft palate for exposure of the growth so that radium needles can be placed directly into the tumor. After insertion of the radium, the incision of the soft palate is immediately sutured. They believe the tumor is operable after two or three radiation treatments. Three cases are reported.

In a consideration of nasopharyngeal tumors Titrud and Peyton [32] describe in detail the neurologic complications which often accompany such tumors. They studied 195 cases with and without such complications. Neurologic symptoms were present in 63 per cent of the cases of squamous cell carcinoma and in 73 per cent of the cases of lymphoepithelioma. The authors recommend irradiation of these neoplasms and state that the base of the skull should be irradiated routinely even if nervous involvement is not obvious at the time of treatment.

As participant in a symposium Brock [33] describes the neurologic aspects of nasopharyngeal tumors. He states that about 50 per cent of these growths produce outstanding signs of involvement of the cranial nerves. The nerves most commonly involved are the fifth and the sixth. Involvement of these nerves produces partial weakness of the external

31. Walker, G. W., and Stock, M. F.: Fibroma of the Nasopharynx, California & West. Med. **54**:10-12 (Jan.) 1941.

32. Titrud, L. A., and Peyton, W. T.: Nasopharyngeal Tumors and Their Neurologic Complications, J. Nerv. & Ment. Dis. **92**:727-742 (Dec.) 1940.

33. Brock, S.: Symposium on Nasopharyngeal Tumors: c.—From the Neurological Viewpoint, Laryngoscope **51**:455-457 (May) 1941.

rectus muscles with diplopia and pain on one side of the face or in or about the eye. It is shown that in 80 per cent of the cases in which there were neurologic signs the fifth or the sixth cranial nerve was involved. Occasionally, the ninth, tenth and eleventh nerves are also involved and when the invasive process involves the petrous-sphenoid region, the third and fourth nerves may become involved. Brock stresses the importance of repeated examinations of the nasopharynx in cases of this type so that a small malignant lesion of the pharynx may not be overlooked.

In the same symposium Babcock[34] considers the otolaryngologic aspects of nasopharyngeal tumors. He describes the outstanding symptoms of nonmalignant nasopharyngeal tumors as bleeding and obstruction. Since bleeding is particularly severe in cases of fibroma or hemangioma, he urges the use of radium in the treatment of these lesions. Nasal obstruction, occasional bleeding, cervical metastasis, trismus and involvement of some of the cranial nerves are listed as common symptoms of malignant tumors of the nasopharynx. He describes radiation treatment of malignant tumors in this region.

Stout,[35] in the same symposium, considers the pathologic aspects of nasopharyngeal tumors. He states that malignant tumors of the nasopharynx are thrice as frequent as benign tumors. Of the benign types fibroma and cysts occur the most frequently, and of the malignant types epithelioma, lymphoepithelioma and cylindromatous carcinoma are most commonly encountered. It is claimed that twenty-seven other types have been recorded but that all of them are exceedingly rare.

That malignant tumors of the nasopharynx are as a rule highly radiosensitive is explained by Kasabach.[36] He states that because of the rapidly metastasizing nature of these lesions and their inaccessibility, adequate roentgen irradiation of the involved regions is the only reliable therapeutic procedure. In the majority of instances total disappearance of the neoplasm, including metastases in the regional lymph nodes, can be achieved. This may be temporary or permanent, depending on the histogenesis of the tumor, the patient's general condition and the extent of the metastatic involvement. Forty-two patients who had malignant tumor of the nasopharynx were treated by the author between 1929 and 1937 and followed three or more years. Fourteen (33.3 per cent) of the

34. Babcock, J. W.: Symposium on Nasopharyngeal Tumors: b.—Otolaryngologic Aspect, Laryngoscope **51**:451-454 (May) 1941.

35. Stout, A. P.: Symposium on Nasopharyngeal Tumors: a.—The Pathological Diagnosis of Nasopharyngeal Tumors, Laryngoscope **51**:446-450 (May) 1941.

36. Kasabach, H. H.: Symposium on Nasopharyngeal Tumors: c.—Roentgenography of the Malignant Nasopharyngeal Tumors; a Preliminary Report, Laryngoscope **51**:459-463 (May) 1941.

42 patients were alive and well. Of these, 7 (16.6 per cent) were clinically free of disease more than five years after the completion of treatment.

Martin and Blady [37] present a lengthy and detailed account of cancer of the nasopharynx. Their results from irradiation of the involved regions were striking. In the Head and Neck Clinic at the Memorial Hospital for the Treatment of Cancer and Allied Diseases, New York, 87 patients were treated in the years 1930 to 1934, inclusive. The net five year survival rate was 25 per cent. The authors stress the facts that cancer of the nasopharynx makes up about 2 per cent of all malignant growths of the head and neck and that owing to the frequent absence of early symptoms in the nasopharynx the diagnosis is frequently delayed or missed entirely. In view of the surgical inaccessibility of the primary lesion and its high radiosensitivity, irradiation of the lesion is recommended as the treatment of choice; a combination of external and intracavitary use of radiation is thought to give the best results.

In a general paper on nasopharyngeal tumors, Davis and Martin [38] stress the importance of early diagnosis. They look with suspicion on the patient who complains of vague or incomplete symptoms of the upper part of the respiratory tract. Two cases are reported. The first patient was a man of 45 years, who died as a result of the tumor; the second patient was a man aged 39, who was living and well three years after treatment by irradiation.

Stinson [39] reviews 2 interesting cases of carcinoma of the nasopharynx. The patients were brothers. One was 10 years of age; the other, 17.

Two cases of carcinoma of the nasopharynx are reviewed by Faier.[40] One patient was a man aged 29. He had suffered for ten months and had undergone three operations on his sinuses before the correct diagnosis was made. Treatment with high voltage roentgen rays gave almost immediate relief of pain, and the patient lived almost two years after the diagnosis was made. The second patient was a man aged 45, who had Ménière's disease as a result of nasopharyngeal carcinoma, which was diagnosed immediately.

37. Martin, H. E., and Blady, J. Y.: Cancer of the Nasopharynx, Arch. Otolaryng. **32**:692-727 (Oct.) 1940.

38. Davis, L., and Martin, J.: The Early Symptoms and Treatment of Nasopharyngeal Tumors, Ann. Surg. **112**:1058-1066 (Dec.) 1940.

39. Stinson, W. D.: Epidermoid Carcinoma of the Nasopharynx Occurring in Two Young Brothers, Ann. Otol., Rhin. & Laryng. **49**:536-539 (June) 1940.

40. Faier, S. Z.: Highly Malignant Tumors of the Nasopharynx, Nebraska M. J. **25**:297-298 (Aug.) 1940.

Cloward [41] reports a case of lymphoepithelioma of the nasopharynx in which many mistakes were made before an accurate diagnosis was made. His article contains a general consideration of cancers in this region.

Farmer [42] reports a case of angioendothelioma of the nasopharynx. The patient was a woman 27 years of age. The growth had become so large that it pushed the soft palate forward and produced dyspnea even when the patient breathed through her mouth. The growth recurred promptly after removal. Subsequently, it was removed surgically and the region irradiated. Microscopically, the malignancy of the lesion was of a low grade, and metastasis had not occurred. The patient was well, and there was no evidence of recurrence of the growth at the time the article was published, eight years after removal of the lesion.

TUMORS OF THE OROPHARYNX AND HYPOPHARYNX

Putney and Fry [43] report 2 cases of retropharyngeal lipoma. One of the patients was a man aged 57 years. His tumor extended into the right side of the neck from the mandible to the clavicle. The second patient was a man aged 40 years. His tumor produced bilateral swelling of the neck. There was marked shortness of breath, and it was difficult for the patient to speak. The authors stress that retropharyngeal lipoma produces symptoms only when it grows sufficiently to cause obstruction to respiration or deglutition. They say that it is possible to distinguish retropharyngeal lipoma from retropharyngeal abscess or malignant tumor without incision or biopsy. In these 2 cases treatment consisted in surgical removal of the tumor through an external incision in the neck. It is recommended that intratracheal anesthesia be used to maintain an adequate airway during such an operation.

Christie [44] classifies malignant tumors involving the pharynx into three types: (1) carcinoma arising from squamous cell epithelium, (2) lymphosarcoma arising from lymphoid elements and (3) lymphoepitheliomas arising from lymphatic epithelium. The symptoms of tumors or cancers of the nasopharynx, mesopharynx and hypopharynx are described briefly. It is the author's belief that the treatment of choice is roentgen irradiation of the involved tissues and that these lesions are out of the domain of operative intervention because they do not remain localized

41. Cloward, R. E.: Nasopharyngeal Cancer, Arch. Otolaryng. **32**:512-516 (Sept.) 1940.

42. Farmer, W. D.: Angioendothelioma of the Nasopharynx, Arch. Otolaryng. **32**:1076-1081 (Dec.) 1940.

43. Putney, F. J., and Fry, K. E.: Retropharyngeal Lipoma, Ann. Otol., Rhin. & Laryng. **49**:967-972 (Dec.) 1940.

44. Christie, A. C.: The Diagnosis and Treatment of Cancer of the Pharynx, Texas State J. Med. **36**:490-494 (Nov.) 1940.

long enough to permit local extirpation. Furthermore, he considers tumors of the following structures to be radiosensitive: nasopharynx, tonsils, posterior pillars, lateral and posterior walls of the mesopharynx, valleculae, epiglottis and the superior portion of the aryepiglottic folds. He expresses the opinion that one may expect a high percentage of cures from external application of radiation to tumors of these structures, although the prognosis is greatly modified if there is involvement of bone or fixation of involved lymph nodes to the mandible or other deep underlying tissues. He states that following external application of radiation to cancers of the anterior pillar, base of the tongue or soft palate there may be marked regression in the size of the tumor. If a small unhealed region remains, he prefers electrocoagulation of this region rather than insertion of radon seeds.

Davis [45] made a study of 14 cases of carcinoma of the base of the tongue and pharynx, 31 cases of carcinoma of the piriform sinus and 24 cases of malignant lesions of the postcricoid region. He describes the symptoms of such cancers but says little about their treatment. Operation was performed in 5 cases in which the lesion was situated in the postcricoid region, but death occurred in all.

New and Dorton [46] describe the result of treatment of 38 patients with malignant disease of the hypopharynx observed at the Mayo Clinic in the years 1927 to 1937. Suspension laryngoscopy was used to gain access to the lesion. Surgical diathermy and radon seeds were then employed. External application of radiation was used as a supplementary measure in some cases. The authors state that in selected cases cancer in this region can be taken care of with less surgical risk when laryngeal suspension is employed than it can when the Trotter operation is employed or when only the external application of radiation is used. The results of treatment were as follows: Of 31 patients treated and traced for three or more years, 23, or 74 per cent, lived more than three years. Of 17 patients treated and traced for five years, 10, or 59 per cent, lived more than five years. In the series there were 3 patients who have lived more than nine years since the conclusion of treatment, and all of these were living at the time the report was made (1940).

TUMORS OF THE LARYNX

The various true benign tumors of the larynx, as well as those of an inflammatory nature, are considered by Hoover.[47] He stresses the differ-

45. Davis, E. D. D.: The Early Diagnosis of Carcinoma of the Oral and Laryngeal Pharynx, Clin. J. **69**:201-206 (Aug.) 1940.

46. New, G. B., and Dorton, H. E.: Suspension Laryngoscopy in the Treatment of Malignant Disease of Hypopharynx and Larynx, Surg., Gynec. & Obst. **72**:930-935 (May) 1941.

47. Hoover, W. B.: Benign Tumors of the Larynx: Their Diagnosis and Treatment, S. Clin. North America **20**:697-719 (June) 1940.

ential diagnosis of benign tumors and other conditions that attack the larynx, principally malignant growths, syphilis, tuberculosis and mycosis. The diagnosis is based on a complete examination and general study of the patient, on laboratory tests and on microscopic examination of material or specimens removed from the larynx. Furthermore, he emphasizes that one benign tumor can be distinguished definitely from another only by a study of microscopic sections. The treatment of benign tumors includes the removal of the growth and other measures which allay irritation. Tracheotomy is done when respiratory obstruction is sufficient to interfere with the activities of the patient. The author stresses the fact that while in most cases of benign tumor the prognosis is excellent, there are some cases in which death may occur from asphyxiation. Furthermore, some benign tumors are said to undergo malignant change. The study by this author consists of an analysis of 155 cases of benign tumor of the larynx. Ten case histories are presented to illustrate the treatment of laryngeal cysts, hemangioma, leukoplakia, fibrous vocal nodules, amyloid tumor, laryngeal prolapse, myxomatous polyps, papilloma, neurofibroma and chondroma.

Smiley [48] reports a case in which polypoid granuloma of the larynx followed endotracheal anesthesia. The patient, who was 35 years of age, received endotracheal cyclopropane anesthesia for operation on the common bile duct. About two weeks later, laryngeal examination revealed a small polyp in the left subglottic region of the larynx. The tumor increased in size and was removed by direct laryngoscopy. On microscopic examination it was found to consist of inflammatory granulation tissue.

A case in which congenital laryngeal cyst caused asphyxia and death is reported by Snaith.[49] The diagnosis was made at necropsy, as the child died within a few hours after birth.

In recent years much interest has been shown in the local application of estrogen to papillomas that occur among children. Broyles [50] reports 5 cases of multiple papilloma of the larynx in childhood. All of the patients were treated by the application of estrogen, apparently with good results. According to the author, estrogen seems to have a definite action on multiple papilloma in children and changes the characteristics of the growth from the infantile to the adult type. This, in turn, makes the treatment simple and satisfactory.

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48. Smiley, W. A.: Polypoid Granuloma of the Larynx Following Endo-Tracheal Anesthesia, Ann. Otol., Rhin. & Laryng. **49**:556-558 (June) 1940.

49. Snaith, L.: Congenital Cyst of the Larynx Causing Fatal Asphyxia Neonatorum, Arch. Dis. Childhood **15**:274-276 (Dec.) 1940.

50. Broyles, E. N.: Treatment of Laryngeal Papilloma in Children, South. M. J. **34**:239-242 (March) 1941.

Suehs and Herbut [51] review briefly the cases of hemangioma of the larynx which have been reported in the literature. They make a detailed report of 1 case. The patient was a boy aged 14 weeks. Owing to dyspnea, a tracheotomy was performed, but the patient died. At necropsy a submucosal mass was found below the left vocal cord. On microscopic examination this proved to be a cellular capillary hemangioma. The authors describe the treatment of this condition.

Poe [52] reports an interesting case of sarcoid of the larynx and describes in detail the differential diagnosis of laryngeal sarcoidosis and laryngeal tubercles secondary to pulmonary tuberculosis. He states that an absolute diagnosis of laryngeal sarcoid is possible only on histologic examination. Since the general pathologist invariably makes a diagnosis of tuberculosis on the microscopic slide, it is advisable, the author states, to send a clinical description of the lesion with the section to the pathologist.

An interesting paper, illustrated with graphic charts, on the increasing incidence of cancer of the larynx is presented by Jackson and Jackson.[53] They state that the only large scale data available for determining the incidence are mortality statistics. However, these statistics understate the rate of occurrence since cancer of the larynx is a curable disease and many patients treated for it survive to die of other diseases. Moreover, the number cured is unquestionably increasing. However, they demonstrate a definite increase in the incidence of cancer of the larynx. The cause of this increase cannot be determined at present. They consider certain possible etiologic factors, such as gasoline fumes, smoking and the use of alcohol. The statistics are summed up in the following manner: About 1 person in every 100 dies every year; about 1 death in every 100 is due to cancer; about 1 of every 100 deaths from cancer is from cancer of the larynx.

Hoarseness in cancer of the larynx, according to Clerf,[54] is significant, since in 80 per cent of all cases of carcinoma of the larynx the lesion arises on a vocal cord. Clerf describes the various types of malignant tumor of the larynx and states that 96 per cent of the tumors are of the squamous cell type, grow slowly and metastasize late. He urges the use of biopsy to insure an accurate diagnosis and states that in 80 per cent of cases in which cancer is limited to a vocal cord the patient can be cured by appropriate surgical treatment.

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51. Suehs, O. W., and Herbut, P. A.: Hemangioma of the Larynx in Infants, Arch. Otolaryng. **32**:783-789 (Oct.) 1940.

52. Poe, D. L.: Sarcoidosis of the Larynx, Arch. Otolaryng. **32**:315-320 (Aug.) 1940.

53. Jackson, C., and Jackson, C. L.: Cancer of the Larynx: Its Increasing Incidence, Arch. Otolaryng. **33**:45-65 (Jan.) 1941.

54. Clerf, L. H.: The Clinical Significance of Hoarseness and Its Importance in Cancer of the Larynx, South. Med. & Surg. **102**:694-695 and 699 (Dec.) 1940.

According to C. L. Jackson,[55] the treatment of cancer of the larynx should be undertaken only after the diagnosis has been established by biopsy. Laryngofissure is the treatment of choice for intrinsic cancer of the anterior portion of the vocal cords. The clipping technic should be used if the lesion involves only the middle third of the cord, and the Chevalier Jackson anterior commissure technic should be employed if the lesion reaches the anterior commissure. Laryngofissure should result in a cure in more than 80 per cent of suitable cases. Laryngectomy is indicated if the lesion involves the arytenoid region, with impairment of motility, or if it extends subglottically. Attention is called to the recent trend toward a "narrow field" type of operation. Laryngectomy should have a low operative mortality and should give at least 50 to 60 per cent of cures in cases of advanced intrinsic cancer in which there is no possibility of cure by laryngofissure. Irradiation by the protracted fractional (Coutard) technic or by radium bomb may be used instead of laryngectomy in cases in which the posterior extent is a little too great for laryngofissure, but preferably when the cord is not fixed. It may also be used when operation is refused, or when the patient's age, temperament or general physical condition contraindicates operation, and in cases of extrinsic or inoperable cancer. In a small series of cases in which only roentgen therapy was used, a three year cure was obtained in 45 per cent.

In a report based on experience with 250 cases in which laryngofissure or laryngectomy was employed for cancer of the larynx Clerf [56] came to the following conclusions: The end results are influenced by the extent of involvement, the site of the growth and the degree of malignancy. True cordal cancer should be treated by laryngofissure; cancer limited to the anterior commissure may be successfully treated by laryngofissure if a large segment of the overlying thyroid cartilage is removed; laryngectomy gives better results than laryngofissure in cases of subglottic cancer. Employment of local anesthesia, prevention of inspiration of blood into the tracheobronchial tree during operation and prompt aspiration of secretions from the trachea after operation will decrease the incidence of postoperative pulmonary complications. Finally Clerf states that while the problems of anesthesia and of preoperative and postoperative management and certain technical differences in the surgical management are important, the outstanding problems from the standpoint of end results relate to the prompt recognition and early diagnosis of cancer so that appropriate treatment may be instituted without delay.

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55. Jackson, C. L.: The Treatment of Cancer of the Larynx, South. M. J. **34**:243-254 (March) 1941.

56. Clerf, L. H.: Cancer of the Larynx: An Analysis of Two Hundred and Fifty Operative Cases, Arch. Otolaryng. **32**:484-498 (Sept.) 1940.

C. L. Jackson [57] describes his method of doing laryngofissure and presents a graphic table of 50 cases. In only 5 of the cases did the growth recur. However, some of the patients have been observed for only six months; the longest period of observation was ten years. There were no operative deaths.

In an article illustrated by some fine drawings and photographs, Gatewood [58] considers the treatment of cancer of the larynx by laryngofissure and laryngectomy. He states that cancer of grade 1 or 2 confined to the anterior half of a vocal cord or to the anterior third of both cords is suitable for treatment by laryngofissure. Cancer involving the arytenoid cartilage is usually unsuitable for this type of operation. He recommends laryngectomy for all intrinsic lesions too far advanced to warrant laryngofissure and also for selected extrinsic lesions. Extrinsic lesions moderately advanced and highly malignant are thought probably unsuitable for any type of laryngectomy. Furthermore, extrinsic lesions associated with involvement of the lymph nodes also are considered inoperable.

Bernheimer [59] made a study of 100 cases of extrinsic cancer of the larynx and reports the end results in 31 cases of intrinsic cancer of the larynx in which surgical treatment was employed. He makes an effort to determine why an early intrinsic lesion progresses until it becomes extrinsic and fatal. He lists the following four factors as the causes: (1) failure of the patient to realize the significance of persistent aphonia, (2) failure of the physician to recognize early obvious pathologic change, (3) an overhanging infantile type of epiglottis, which makes examination of the larynx difficult and (4) subglottic growths hidden beneath the cord, which are difficult to detect even on direct laryngoscopic examination. Postoperative recurrence or metastasis occurred in only 4 of the 31 cases of intrinsic cancer. However, some of the patients have been observed for only a few months. Others have remained well for as long as eleven years.

Martin [60] considers the selection of treatment for cancer of the larynx. For intrinsic growths he recommends partial laryngectomy (larygnofissure) or total laryngectomy, depending on the size, the site and the grade of the growth. In cases in which the grade of malignancy is 3 or 4 and there is some doubt as to the exact site of origin of the

57. Jackson, C. L.: Laryngofissure for Cancer of the Larynx: Observations Based on a Series of Fifty Consecutive Cases, Arch. Otolaryng. **33**:520-535 (April) 1941.

58. Gatewood, E. T.: Diagnosis and Selection of Treatment for Carcinoma of the Larynx, Virginia M. Monthly **68**:330-335 (June) 1941.

59. Bernheimer, L. B.: Carcinoma of the Larynx, Ann. Otol., Rhin. & Laryng. **49**:418-426 (June) 1940.

60. Martin, H. E.: Selection of Treatment for Cancer of the Larynx, Ann. Otol., Rhin. & Laryng. **49**:728-735 (Sept.) 1940.

growth, fractional irradiation of the region or laryngectomy with interstitial implantation of radon is recommended. The author is of the opinion that fixation of one vocal cord with swelling of the arytenoid markedly reduces the possibility of complete removal of the growth by laryngectomy. Here again irradiation of the region is thought to be probably the treatment of choice. It is the author's opinion that this type of treatment is the usual one of choice in cases of extensive laryngeal involvement, since laryngeal cancers are usually highly radiosensitive.

After twenty years' experience, Salinger [61] presents a lengthy paper on his observations and conclusions concerning the treatment of carcinoma of the larynx. He rather favors operation in cases in which the lesion is operable and believes that postoperative irradiation of the region is tolerated better than postirradiation surgical treatment. He describes the distressing symptoms which follow radiation necrosis of the larynx and stresses the point that no patient should ever be subjected to laryngeal operation or irradiation without a preliminary biopsy. The best results of treatment can be obtained, he says, only when the laryngologist, the radiotherapeutist and the pathologist cooperate to the fullest extent without prejudice.

Looper [62] describes the surgical treatment of cancer of the larynx and stresses the need for early diagnosis and differential diagnosis of this condition. He is of the opinion that endolaryngeal operations have a very limited sphere of usefulness. Laryngofissure is considered an ideal operation for cancer of the larynx, but unfortunately only 20 per cent of the patients are seen early enough for this type of operation. In many cases laryngeal cancer must be treated by laryngectomy. Looper states that roentgen therapy is of most value after the cancer of the larynx has been removed and should not be used before operation. He describes in detail his technic of doing laryngectomy through a T-shaped incision. Rectal anesthesia, particularly if induced by administration of avertin with amylene hydrate, is recommended for laryngectomy.

In a general consideration of cancer of the larynx Foster [63] draws the following conclusions: 1. All patients who have undifferentiated cancer of the larynx should be treated by irradiation of the lesion. 2. Certain small malignant cancers may be successfully dealt with by endolaryngeal operation. 3. Laryngofissure is the operation of choice in cases of differentiated cordal cancer. 4. Laryngectomy is indicated in cases in which the involvement is more extensive. 5. Laryngectomy plus the use of radiation is the procedure of choice in cases in which the lesion has extended beyond the voice box.

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61. Salinger, S.: Radiation Therapy for Carcinoma of the Larynx: Observations After Twenty Years, Arch. Otolaryng. **32**:887-902 (Nov.) 1940.

62. Looper, E. A.: The Diagnosis and Surgical Treatment of Carcinoma of the Larynx, South. Surgeon **9**:513-521 (July) 1940.

63. Foster, J. H.: Selective Treatment of Cancer of the Larynx, Texas State J. Med. **36**:370-372 (Sept.) 1940.

According to Peck, Maxwell and Lamberson,[64] the prognosis in a case of carcinoma of the larynx is dependent to a great extent on the stage of advancement of the lesion when treatment is instituted. The following statements are made: Intrinsic carcinoma of the larynx carries a more favorable prognosis than other cancers of the larynx. Hemilaryngectomy has given satisfactory results in cases in which the intrinsic lesion is confined to one vocal cord. Small extrinsic lesions diagnosed as carcinoma in the authors' series of cases have responded comparatively well to irradiation. The unfavorable prognosis for far advanced laryngeal cancer has not been changed appreciably by either total laryngectomy or irradiation.

A method of using nitrous oxide and oxygen as the means of maintaining anesthesia when performing laryngectomy is described by Kemler.[65] He expresses the opinion that this type of anesthetic is ideal, perfectly safe and not irritating to the lungs. The fact that the patient is awake immediately on conclusion of the operation is stressed. After severance of the larynx from the trachea, the anesthetic is administered through a specially adapted tube directly into the trachea.

Arbuckle and Stutsman[66] give an interesting preliminary report of 4 cases of laryngopharyngeal cancer in which patients were treated by a combination of operation and irradiation. The authors state that ordinary treatment by irradiation in such cases has been encouraging but that the effects of radiation on the cartilages of the larynx is most discouraging. Consequently, in an effort to avoid the reaction of the laryngeal cartilages following their irradiation for cancer of the pharynx and laryngopharynx, the authors have removed the normal thyroid and epiglottic cartilages before instituting radiation therapy. In the 4 cases reported the cartilages were removed through a midline incision and were excised subperichondrially.

Cutler[67] expresses the opinion that the microscopic structure of cancer of the larynx as determined at biopsy gives no indication of the radiosensitivity of the tumor. He said that the most important indication of radiosensitivity is the mobility of the lesion in the surrounding

64. Peck, W. S.; Maxwell, J. H., and Lamberson, F.: Carcinoma of the Larynx: A Review of One Hundred and Seventy Consecutive Cases, Laryngoscope **51**:97-107 (Jan.) 1941.

65. Kemler, J. I.: Nitrogen Monoxide and Oxygen for Anesthetization in Operations for Malignant Growths of the Larynx, Arch. Otolaryng. **33**:707-710 (May) 1941.

66. Arbuckle, M. F., and Stutsman, A. C.: Pharyngeal and Laryngopharyngeal Cancer: A New Combination of Surgery and Radiation Therapy in Their Treatment; Preliminary Report of Four Cases, South. M. J. **34**:219-220 (Feb.) 1941.

67. Cutler, M.: Cancer of the Larynx: Relation Between Gross Anatomy, Microscopic Structure and Radiosensitivity, J. A. M. A. **115**:1339-1345 (Oct. 19) 1940.

structures. Furthermore, an undifferentiated carcinoma usually remains movable in spite of its large size, whereas a small infiltrating differentiated carcinoma may cause complete fixation of the vocal cord when the lesion is quite limited in extent. It is Cutler's opinion that the prognosis for the former type is comparatively favorable under radiation treatment in spite of its size and in spite of regional metastasis. Then again, the prognosis in cases in which the differentiated type is under irradiation, according to the author, is most unfavorable in spite of the fact that the lesion is very small and limited in extent.

Brighton, Altmann and Hagan [68] review 16 cases of intralaryngeal and extralaryngeal neoplasms. The patients were 47 to 78 years of age. The reactions of normal laryngeal tissue and of cancer tissues to fractional roentgen therapy are outlined. There were no definite changes of the musculature, bone or cartilage due primarily to radiation effect. The reaction of cancer tissues was found inconsistent with the histologic structure; it was connected more definitely with the site of the tumor. However, the authors admit that the criterion of site was not sufficient for predetermining the exact results of irradiation of cancers. The effects of radiation on cancer tissues are described in detail.

TUMORS OF THE EOSPHAGUS

Smith [69] describes an interesting case of esophageal fibrolipoma. The patient was a man aged 81 years, who had some dysphagia and, in addition, an acute attack of dyspnea. On direct laryngoscopic examination, two tumors, diagnosed as fibrolipoma, were found attached to the upper part of the esophagus. One of these was 4 inches (10.16 cm.) long and ½ inch (1.27 cm.) in diameter, and the other was 3 inches (7.6 cm.) long and 1 inch (2.5 cm.) in diameter. These were extremely mobile and were later removed.

Mahoney [70] reports 2 cases of polypoid tumor of the esophagus. Since it is sometimes difficult to arrive at an accurate diagnosis, the author believes that all esophageal polypoid lesions should be considered malignant until proved otherwise. The first patient was a man aged 73 years, who had had difficulty in swallowing for three weeks. Biopsy was done twice. The microscopic appearance of the first specimen was indefinite and the lesion was considered a polyp, but the second specimen disclosed squamous cell epithelioma. The second patient was a man

68. Brighton, G. R.; Altmann, F., and Hagan, C., Jr.: Reactions of Laryngeal Tissues Following Extended Fractional Roentgen Irradiation, Arch. Otolaryng. **33**:631-658 (April) 1941.

69. Smith, R.: Polypoid Fibro-Lipomatosis Pharyngis, J. Laryng. & Otol. **55**:546-548 (Dec.) 1940.

70. Mahoney, J. J.: Polypoid Tumors of the Esophagus: Report of Two Cases, Laryngoscope **50**:1086-1091 (Nov.) 1940.

aged 54, who had experienced increasing difficulty in swallowing for seven years. Esophagoscopy disclosed a mass near the aortic notch and another at the lower end of the esophagus. Both of these tumors proved to be polyps.

Adams [71] lists the following reasons to account for unsuccessful treatment of carcinoma of the esophagus: (1) lack of an early correct diagnosis, (2) poor results from roentgen therapy, and (3) high mortality following operative treatment. Malignant esophageal tumors were divided into three types: scirrhous carcinoma, medullary carcinoma and papillary carcinoma. According to the author, the symptoms of these lesions are based on mechanical obstruction of the esophagus, the influence of the tumor on the adjacent structures and metastatic growths. The three outstanding symptoms are disturbances of deglutition, pain, and loss of weight and strength. The author discusses the surgical treatment of such tumors. He presents 4 cases illustrating the subject matter of his paper.

Levitt,[72] in a consideration of carcinoma of the larynx, says that a combination of external application of radiation and internal irradiation with radium will eventually succeed in curing some patients with carcinoma of the esophagus. He classified malignant esophageal tumors as follows: stage 1, carcinoma of the esophagus uncomplicated and without evidence of extension beyond the esophageal wall; stage 2, carcinoma of the esophagus with extension to mediastinal or superficial glands; stage 3, carcinoma of the esophagus with or without involvement of lymph nodes but with complicating mediastinitis or with generalization of the disease. Lesions classified as stage 1 were regarded as technically curable; those classified as stage 2 were said to be suitable only for palliation in selected instances; lesions classified as stage 3 should not be treated by radiotherapy. Exceptions to this rule of treatment were soft, fungating growths involving the esophagus extensively. These he believes should be treated in a manner similar to that for growths of the posterior mediastinum and not as esophageal tumors. The second exception to the treatment is carcinoma of the lower end of the esophagus, which, the author points out, is really carcinoma of the fundus of the stomach which has extended upward.

Rhudy [73] asserts that there are only two methods of diagnosing cancer of the esophagus: (1) by roentgenologic examination and (2) by esophagoscopy. He emphasizes the following points: 1. The cure

71. Adams, W. E.: Pathologic Considerations Relating to Early Diagnosis and Curative Surgical Treatment of Carcinoma of the Esophagus, Surg., Gynec. & Obst. **72**:105-110 (Feb.) 1941.

72. Levitt, W. M.: The Staging of Malignant Disease: Carcinoma of the Esophagus, J. Laryng. & Otol. **55**:251-253 (May) 1940.

73. Rhudy, B. E.: Symposium on the Early Signs and Symptoms of Cancer: Cancer of the Esophagus, North Carolina M. J. **1**:341-342 (July) 1940.

depends on early diagnosis. 2. A carefully obtained history, with proper evaluation of seemingly insignificant incidents, leads to an early diagnosis. 3. A diagnosis of spasmodic stenosis of the esophagus and cardiospasm—which, he says, are rare in his experience—should never be made until cancer of the esophagus has been excluded. 4. Every patient with abnormal sensation in swallowing, even though it may be very slight, should be promptly examined by an experienced roentgenologist. 5. Esophagoscopy competently performed is the means of making a diagnosis early and of persuading a comparatively well patient to undergo treatment at a stage when there will be some hope of obtaining a cure.

Pearlman [74] describes esophageal carcinosarcoma, which is an extremely rare form of malignant disease of the esophagus. A review of the literature on this particular type of tumor is presented. The author reviews 8 cases in which a diagnosis of carcinosarcoma of the esophagus might have been considered, from the pathologic point of view. From his study of the world's literature and of these 8 cases he is of the opinion that the occurrence of so-called carcinosarcoma of the esophagus, as of other sites, is very questionable. The possible sources of error leading to such a diagnosis are analyzed.

French and Garland [75] report a case of primary leiomyosarcoma of the esophagus. The patient was a man 70 years of age. This is the fifth case of this particular type of cancer to be described in the literature. As in some of the other reported cases, the tumor was long and polypoid, and at first glance simulated boluses of food both on roentgenoscopic and esophagoscopic examination. The lesion at first was erroneously reported to be carcinoma, but subsequent postmortem studies revealed the true nature of the growth. Although bulky and partly ulcerated, the tumor had not invaded the deeper layers of the esophageal wall and, as the authors point out, might have been removable had the true pathologic condition been suspected.

Benedict [76] reports 2 cases in which carcinoma developed in a benign stricture of the esophagus. In the first the cancer arose at the site of a congenital stricture; in the other, at the site of a lye burn. The literature is carefully reviewed, and the possible etiologic factors are briefly considered. Carcinoma developing in a benign stricture is rare. It has been more commonly reported following a lye burn than in association with any other type of benign stricture. The importance of esophagoscopy under local anesthesia in the diagnosis and treatment was emphasized.

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74. Pearlman, S. J.: So-Called Carcino-Sarcoma of the Esophagus, Ann. Otol., Rhin. & Laryng. **49**:805-820 (Sept.) 1940.

75. French, L. R., and Garland, L. H.: Leiomyosarcoma of the Esophagus, Am. J. Roentgenol. **45**:27-31 (Jan.) 1941.

76. Benedict, E. B.: Carcinoma of the Esophagus Developing in Benign Stricture, New England J. Med. **224**:408-412 (March 6) 1941.

TUMORS OF THE TRACHEA

Barrett [77] presents the case history of a patient aged 66 years who had a large fibroma of the trachea in the region of the aortic arch and stretching upward to the base of the neck. It was attached to the esophagus. An attempt was made to remove it by right anterior thoracotomy. However, it could not be excised without irreparable damage to the esophagus. The patient died thirty-six hours after operation.

Harris [78] briefly considers the diagnosis and treatment of tumors of the trachea. He states that the symptoms are not sufficient for making a diagnosis and often closely resemble those of asthma, such as wheezing respiration, nocturnal attacks of dyspnea, and dyspnea on exertion. The diagnosis is based on laryngoscopy and bronchoscopy.

77. Barrett, N. R.: Fibroma of the Esophagus: Report of a Case, J. Thoracic Surg. **9**:672-678 (Aug.) 1940.

78. Harris, H. E.: Tumors of the Trachea, Cleveland Clin. Quart. **7**:261-264 (Oct.) 1940.

Special Reports

TENTATIVE STANDARD PROCEDURE FOR EVALUATING PERCENTAGE OF USEFUL HEARING LOSS IN MEDICOLEGAL CASES

Because of the lack of uniformity in estimating the percentage loss of useful hearing as pointed out by courts of law, insurance companies, compensation courts and others, the Consultants on Audiometers and Hearing Aids of the Council on Physical Therapy in 1938 formulated a method for the consideration of otologists and physicians. The House of Delegates, at its annual meeting in 1939, approved the action of the Consultants for the standardization of tests and the preparation of a method for estimating the percentage loss of hearing.

The following method was prepared by the consultants and adopted by the Council on Physical Therapy and by the Section on Laryngology, Otology and Rhinology at the Ninety-Third Annual Session of the American Medical Association in 1942. It was also adopted by the House of Delegates at its annual meeting in Atlantic City, N. J., in June 1942.

The Council on Physical Therapy wishes to express its appreciation for the valuable assistance rendered in the preparation of this report to Drs. C. C. Bunch (deceased), George M. Coates, Edwin P. Fowler, W. E. Grove, Isaac H. Jones, Douglas Macfarlan, C. Stewart Nash, Horace Newhart, Paul E. Sabine, Burt R. Shurly and William P. Wherry (deceased).

HOWARD A. CARTER, *Secretary to the Council on Physical Therapy.*

1. Since the pure tone audiometer is the best available instrument for determining the loss of acuity of hearing, the procedure recommended herein is based on measurements of hearing loss with an accepted standard audiometer. Since, in the present state of knowledge, it is not possible to arrive at quantitative evaluation of hearing impairment except by audiometric measurements, no consideration is given to other than audiometric findings in setting up this basic procedure.

2. The recommended procedure is based only on threshold measurements of acuity of hearing for air-conducted sound.

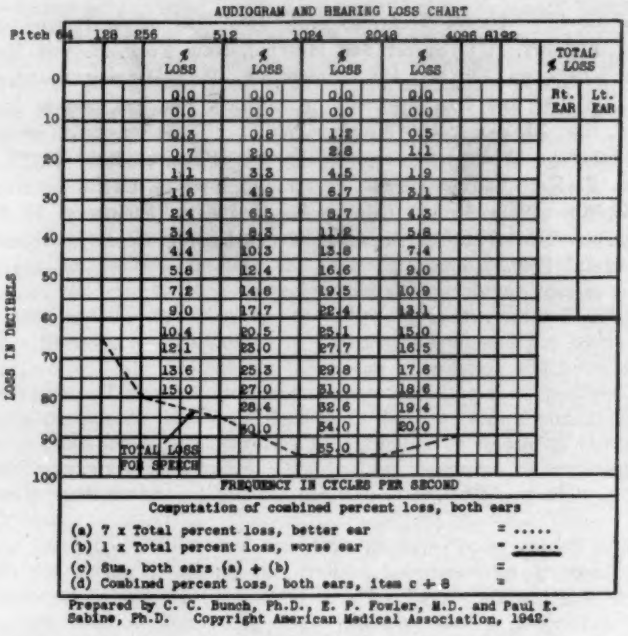
3. The following decibel losses, as measured by an accepted standard audiometer, represent 100 per cent loss of useful hearing:

128	256	512	1024	2048	4096	Cycle/Sound
65	80	85	95	95	90	Decibels

4. Percentage losses corresponding to measured decibel losses in the octave intervals are shown on the accompanying chart. These percentages are based on existing data bearing on the relative values of the different portions of the auditory range for intelligibility of direct speech.

5. In using the accompanying chart for evaluating percentage loss of hearing, the procedure is as follows:

Measured hearing losses at the different frequencies for each ear are plotted in the usual manner. Successive points are connected by straight ruled lines. The percentage loss to be assigned to each octave interval is the figure in the space immediately above the straight line drawn in that octave. (When two or more spaces are intersected, the average of the figures in the intersected spaces is to be taken.) The figures for the four octaves for each ear are set down in their respective columns


AUDIOGRAM AND HEARING LOSS CHART

Pitch 64 128 256 512 1024 2048 4096 8192

	% LOSS	% LOSS	% LOSS	% LOSS	TOTAL % LOSS Rt. EAR	TOTAL % LOSS Lt. EAR
0						
	0 0	0 0	0 0	0 0		
10	0 0	0 0	0 0	0 0		
	0 3	0 8	1 2	0 5		
20	0 7	2 0	2 8	1 1		
	1 1	3 3	4 5	1 9		
30	1 6	4 9	6 7	3 1		
	2 4	6 5	8 7	4 5		
40	3 4	8 3	11 2	5 8		
	4 4	10 3	13 8	7 4		
50	5 8	12 4	16 6	9 0		
	7 2	14 8	19 5	10 9		
60	9 0	17 7	22 4	13 1		
	10 4	20 5	25 1	15 0		
70	12 1	23 0	27 7	16 5		
	13 6	25 3	29 8	17 6		
80	15 0	27 0	31 0	18 6		
		28 4	32 6	19 4		
90		29 0	34 0	20 0		
	TOTAL LOSS FOR SPEECH		35 0			
100						

LOSS IN DECIBELS

FREQUENCY IN CYCLES PER SECOND

Computation of combined percent loss, both ears

(a) 7 x Total percent loss, better ear = ...
(b) 1 x Total percent loss, worse ear = ...
(c) Sum, both ears (a) + (b) =
(d) Combined percent loss, both ears, item c ÷ 8 =

Prepared by C. C. Bunch, Ph.D., E. P. Fowler, M.D. and Paul E. Sabine, Ph.D. Copyright American Medical Association, 1942.

Audiogram and hearing loss chart.

headed "Right Ear" and "Left Ear" at the right of the chart. The sum of the figures in the column headed "Right Ear" is the total percentage loss of hearing for the right ear, and similarly for the left ear.

6. Computation of combined hearing loss for both ears is indicated at the bottom of the chart. The weighting of percentage loss shown by the better ear as compared with that shown by the worse ear of 7 to 1 represents the composite judgment of the committee based on both clinical experience and practical considerations. The percentage loss of hearing is the average of the losses for the two ears taken separately weighted in the ratio of 7 to 1.

7. The percentages shown on the accompanying chart were arrived at from quantitative data.[1]

The foregoing procedure is recommended as a tentative standard based on present knowledge of the relation between the audiometrically measured acuity of hearing and the ability to interpret direct speech in a familiar language.

This procedure is subject to revision when further authoritative data on the problem become available.

By writing to the Secretary of the Council on Physical Therapy, one may purchase charts on 4 by 5 inch cards.

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1. Bunch, C. C.: Usable Hearing, Ann. Otol., Rhin. & Laryng. **49**:359 (June) 1940. Fletcher, H.: Speech and Hearing, New York, D. Van Nostrand Company, Inc., 1929, pp. 136 and 158. Fowler, E. P.: Hearing Standards for Acceptance, Disability and Discharge in the Military Services and in Industry, Tr. Am. Otol. Soc. **31**:243, 1941. Knudsen, V. O.: The Sensibility of the Ear to Small Differences of Intensity and Frequency, Physical Rev. **21**:84 (Jan.) 1923. Sabine, P. E.: Estimating the Percentage Loss of Useful Hearing, Tr. Am. Acad. Ophth. (1941) **49**:179 (March-April) 1942. Steinberg, H. C., and Gardner, M. B.: The Auditory Significance of Hearing Loss, J. Acoust. Soc. Am. **11**:270 (Jan.) 1940.

Abstracts from Current Literature

Ear

INJURIES OF THE EAR: A DISCUSSION. LIONEL COLLEDGE AND OTHERS, Proc. Roy. Soc. Med. (Sect. Otol.) **34**:5 (Nov.) 1940.

Injuries caused by explosions, Colledge stated, can be grouped roughly into two classes: those in which there is a gross tympanic injury and those with concussion of the labyrinth without signs of injury to the tympanum. These injuries may be combined. He mentioned that the tympanic membrane may be blown out, the edges of the perforation being everted instead of inverted into the tympanum. Concussion of the labyrinth can be produced either by transmission of the effects of a blow on the head through the bones of the skull or by sudden increase in atmospheric pressure from an explosion. The changes in atmospheric pressure experienced by aviators give rise to damages of the ear which have been termed acute and chronic aero-otitis media. Fractures of the skull involving the temporal bone may be limited to the external and bony meatus, to the mastoid process or to the walls of the tympanum or they may pass through the petrous portion. Fractures of the latter may be longitudinal, transverse or oblique. In the typical longitudinal fracture the tympanic membrane is torn and the middle ear opened, while in the transverse fracture the membrane remains intact, but the facial nerve is liable to injury and the labyrinth is fractured. The oblique fracture combines the principal characters of the longitudinal and the transverse fracture. The longitudinal type exposes the tympanum to infection and some immediate risk of meningitis. The transverse fracture or any type that involves the labyrinth induces a permanent liability to meningitis from a chance attack of otitis media. In the examination of such injuries all syringing or lavage to clean the external auditory canal must be avoided. The earliest symptoms of meningitis in patients with such fractures should call for the radical mastoid operation and exposure of the labyrinth.

Miss Josephine Collier cited statistics and experiences gained in observation of ear injuries produced among the civilian population of Barcelona by air-raid bombardments during the Spanish War. Her figures showed that between 30 and 60 per cent of those injured by high explosive bombs had middle ear injuries, traumatic rupture of the tympanic membrane being extremely common.

Mr. V. E. Negus showed a table analyzing 622 civilian air-raid casualties with a total of 199 head injuries. The total number of ear injuries was 3.8 per cent of the casualties.

Mr. F. W. Watkyn-Thomas, Mr. W. M. Mollison, Mr. E. D. D. Davis, Dr. Hugo Frey and others commented on various aspects of ear injuries, cited cases and described individual variations in the treatment. CAMPBELL, Philadelphia.

MASTOIDITIS IN INFANCY. J. C. OREGGIA, Arch. de pediat. d. Uruguay **10**:585 (Oct.) 1939.

The author describes three types of mastoiditis occurring in infancy: (1) simple, (2) complex and (3) occult. The one of most interest to the pediatrician is the third type, which results from obscure fever in the absence of all other physical findings. This type is found particularly in malnourished children and commonly develops into mucopurulent osteitis. The diagnosis can often be made by roentgen examination. SCHLUTZ, Chicago. [AM. J. DIS. CHILD.]

MASTOIDITIS AND RETROAURICULAR LYMPHANGITIS. YAGO FRANCHINI, FRANCISCO BLOTTA and DOMINGO GUASTAVINO, Rev. méd. latino-am. **26**:58 (Oct.) 1940.

The authors distinguish between mastoidism, false mastoiditis and true mastoiditis and outline the medical treatment for each of these conditions. They emphasize the gravity of mastoiditis associated with cellulitis of the external ear and the importance of roentgen examination in deciding whether surgical intervention is indicated.

DWYER, Kansas City, Mo. [AM. J. DIS. CHILD.]

PNEUMOCOCCIC MENINGITIS FOLLOWING OTITIS MEDIA, HEALED AFTER A RAMADIER OPERATION AND TREATMENT WITH SULFAPYRIDINE AND SPECIFIC ANTIPNEUMOCOCCUS SERUM. P. G. GERLINGS and C. M. KRÖGER-WIBAUT, Nederl. tijdschr. v. geneesk. **84**:1494 (April 20) 1940.

In a girl of 10 years acute otitis media with petrositis developed into pneumococcic meningitis. On operation by the method of Ramadier pus was found in a cavity in the apex of the petrous bone. After the operation high daily doses of sulfapyridine were given, after which the general condition improved, the temperature settled down and the fluid became sterile. From the sixth day after the operation the condition became worse again; the temperature rose, and pneumococci again appeared in the fluid. Continued sulfapyridine treatment could not modify the condition. After addition to the treatment of daily intravenous doses of 20,000 units of specific antipneumococcus serum for four days, the patient recovered within a short time. The combination of chemotherapy and serum in the treatment of pneumococcic meningitis is commented on.

VAN CREVELD, Amsterdam, Netherlands. [AM. J. DIS. CHILD.]

PARALYSIS OF CONTRALATERAL ABDUCENS NERVE IN OTOGENIC MENINGITIS. W. J. POTHOVEN, Nederl. tijdschr. v. geneesk. **84**:2238 (June 15) 1940.

The author reports on 2 patients, 13 and 19 years old, who recovered from otogenic meningitis complicated by paralysis of the contralateral abducens nerve two and eighteen days respectively after the operation on the ear. The abducens nerve healed without any further surgical measures. Homolateral and contralateral paralysis of the abducens nerve in the course of infections of the ear are discussed.

VAN CREVELD, Amsterdam, Netherlands. [AM. J. DIS. CHILD.]

EXAMINATION OF THE AUDITORY FUNCTIONS OF SCHOOL CHILDREN IN THE COUNTRY. P. BELGRAVER, Nederl. tijdschr. v. geneesk. **84**:4359 (Nov. 9) 1940.

School children among the rural population in certain districts of the Netherlands were examined for their hearing of the whispered voice. It was found that the number of children in need of special teaching for impaired hearing was considerably higher than in the large towns, especially than in Amsterdam. This fact should be taken into account in determining the number of special schools required for this purpose. By greatly individualized care on the part of the teacher of the child with defective hearing, the results of teaching such children in ordinary schools can also be improved. As this possibility will remain an exception, in the rural districts special schools for children with defective hearing can be anticipated by means of intensifying the supervision by school medical officers and extension of the possibility of attending at otologists' clinics. The establishment of ambulant clinics deserves considerations for some parts of the Netherlands.

VAN CREVELD, Amsterdam, Netherlands. [AM. J. DIS. CHILD.]

FATAL CASE OF OSTEOMYELITIS OF BASE OF SKULL FOLLOWING ADENOIDECTOMY. T. KRARUP, Nord. med. **7**:1613 (Sept. 27) 1940.

A girl of 6 years had undergone adenoidectomy during an unnoticed attack of acute otitis media. High fever developed after the operation. She was first seen

six days later. There were no meningitic signs. Purulent otitis media was present on the right side, with mastoiditis, for which an operation was performed. Three days after her admission to the hospital there was pleocytosis, with hemolytic streptococci in the spinal fluid. The child died thirteen days after the adenoidectomy. The postmortem examination revealed an osteitic process of the ethmoid and sphenoid bones. WALLGREN, Göteborg, Sweden. [AM. J. DIS. CHILD.]

OTITIC HYDROCEPHALUS WITHOUT PAPILLARY EDEMA. C. CHR. BAGER, Ugesk. f. læger **102**:338 (April 4) 1940.

After mild purulent otitis a 7 year old boy displayed severe symptoms and signs of cerebral disease, with involvement of the posterior cranial fossa. At the operation inflammatory changes were noted on the posterior surface of the pyramid. Puncture of the dura mater produced a large quantity of fluid. Remarkable clinical improvement and an uneventful recovery followed.

WALLGREN, Göteborg, Sweden. [AM. J. DIS. CHILD.]

Pharynx

TUBERCULOSIS OF TONSILS. E. ROSENCRANTZ and SAMUEL HURWITZ, Am. Rev. Tuberc. **43**:388 (March) 1941.

Tonsillectomy and adenoidectomy were performed on 103 girls, aged from 8 months to 13 years, who reacted positively to tuberculin. Careful examination of the tonsils removed demonstrated tuberculous involvement of 19. The gastric contents of 18 of these children were shown to contain tubercle bacilli by guinea pig inoculation. Clinical pulmonary tuberculosis was present in 8 of these children; enlargement of hilar nodes was present in 9, pleural effusion in 2, and cervical lymphadenitis in association with enlargement of hilar nodes in 2. One of the last-mentioned 2 children also had tuberculosis of the bones.

The tonsils themselves showed no characteristic macroscopic changes. The lesions were either unilateral or bilateral. The surface epithelium was intact; giant cell formation was common, but caseation was not a marked feature. Tubercle bacilli were rarely demonstrated. In 1 case the adenoid tissue alone showed tuberculous involvement.

While no theory as to the exact method by which the tonsils become infected is offered, the authors maintain that a definite relation between tuberculous tonsils and the presence of tubercle bacilli in the gastric contents must be considered.

EUGENE SMITH, Ogden, Utah. [AM. J. DIS. CHILD.]

SURGICAL RESPONSIBILITY IN TONSILLECTOMY. LEWIS W. JORDAN, Northwest Med. **40**:47 (Feb.) 1941.

It has been estimated that 1,235,000 tonsillectomies are performed each year in the United States. Numerous workers have been critical of this procedure because the results in many instances have not been beneficial enough to justify it. In a recent survey of university students, 77 per cent were found to have tonsillar remnants in the fossae. The author reports a study of 100 pairs of tonsils, in which 70 per cent of the specimens showed removal of portions of the pillars, and at least 15 per cent, incomplete removal of the tonsils.

The mere fact that tonsils are enlarged does not justify their removal, provided they are not causing local or general disturbances. The author discusses the technic of tonsillectomy from the standpoint of the adult. For the children he advises the use of the La Force tonsillotome.

In spite of meticulous removal of lingual lymphatic tissue, almost 100 per cent of the preadolescent patients will show some degree of postoperative hypertrophy. This seldom acts as a forerunner of infection.

ROBERTSON, Omaha. [AM. J. DIS. CHILD.]

CAUSES OF HYPERTROPHIC TONSILS IN CHILDREN. DOMINGO F. GUSTAVINO, Rev. méd. latino-am. **26**:607 (March) 1941.

Among the millions of children whom the author had occasion to examine a large number suffered from hypertrophic tonsils. Many had suffered from frequent attacks of tonsillitis and many from ganglion infarcts causing a disturbance in swallowing and pronunciation.

Why are there so many children with hypertrophic tonsils? A local infection is one of the most important causes. With frequent attacks of tonsillitis, swallowing becomes difficult, and it is easy for bacteria to penetrate and cause a chronic inflammation. It is necessary to clean the cavities or fauces at an early age and also to teach children better oral hygiene, such as the use of gargles and a method of blowing the nose and keeping the nasal passages clean. Hypertrophy of the tonsils may result from infectious diseases, anatomic abnormalities and variations in temperature.

Proper hygienic habits will reduce the incidence of tonsillar enlargement and tonsillitis.

DWYER, Kansas City, Mo. [AM. J. DIS. CHILD.]

LITIGATION OF THE CAROTID ARTERY FOR HEMORRHAGE DUE TO EROSIONS FOLLOWING PERITONSILLAR ABSCESS. JOHANNES STABENAU, Ztschr. f. Hals-, Nasen- u. Ohrenh. **47**:125 (Dec.) 1940.

Stabenau, in discussing the problem of carotid hemorrhage, states that, owing to the high mortality of the procedure, the indications for ligation of the carotid artery have become more limited. He believes that ligation should be employed only (1) after injury to the blood vessel, (2) in cases of erosion of the vessel due to a peritonsillar or parapharyngeal abscess, (3) in cases of hemorrhage following a malignant tumor the extirpation of which would injure the blood vessel and, finally, (4) in operations for aneurysm.

The author presents 7 cases of bleeding from the carotid artery. He stresses conservative measures, but when these fail ligation must be undertaken. His routine is to expose the carotid artery and employ extensive tamponage; then, if he is unsuccessful in stopping the hemorrhage, he ligates the external carotid artery, but at the same time places loose ligatures about the common carotid artery. If this procedure is insufficient, he ties the ligatures about the common carotid artery.

In his series, patients 1, 2, 3 (who died) and 6 required ligation of the carotid artery; patient 4 recovered after simple tamponage of the peritonsillar cavity; patient 5 recovered after removal of the tonsil and ligation of a large exposed blood vessel in the inferior segment of the tonsillar fossa, and patient 7 died of a massive spontaneous hemorrhage before any operative procedure could be undertaken.

PERSKY, Philadelphia.

Larynx

THE ROLE OF BRONCHOSCOPY IN THE TREATMENT OF PULMONARY ABSCESS. CHEVALIER L. JACKSON and A. R. JUDD, J. Thoracic Surg. **10**:179 (Dec.) 1940.

The authors review 124 cases of nontuberculous pulmonary abscess in which it was proved by roentgen examination that unilocular cavities were present. In 113 a bacteriologic study of bronchoscopically removed bronchial secretions was carried out. There were twice as many male as female patients. The most common cause was a preceding surgical operation. Among the surgical procedures, tonsillectomy predominated; general anesthesia was employed in all stated instances except 3. The right lung was affected in 91 cases.

Mortality figures remain high. The rate was 29.4 per cent in 78 cases in which conservative treatment was used. The rate in 37 cases in which the condition was

treated surgically was somewhat higher, but these cases included a few in which treatment with procedures now generally abandoned was employed. External drainage proved to be the most effective surgical measure and is recommended in all cases in which surgical intervention is required, except when complicating conditions demand lobectomy or pneumonectomy. Surgical intervention is recommended when progress is not rapid and unmistakable.

Otherwise conservative treatment is advised. This includes such measures as rest in bed, good nursing care, dietary and symptomatic treatment, postural drainage, bronchoscopic examination, transfusions, vaccination, intravenous therapy and administration of neoarsphenamine. DORSEY, Chicago. [AM. J. DIS. CHILD.]

ACUTE LARYNGEAL OBSTRUCTION AS A COMPLICATION OF MEASLES. H. H. SHUMAN, New England J. Med. **224**:727 (April 24) 1941.

Acute laryngeal obstruction is a rare but serious complication of measles. Statistically, it occurred in less than 1 per cent of the total number of patients with measles (3,677) admitted to the Willard Parker Hospital from June 1931 to June 1934. Contrary to most opinions, acute laryngeal obstruction can occur in any stage of measles—in the preeruptive, eruptive or posteruptive stage. Pathologically, in the patients examined the edema was located chiefly in the supraglottic area and was usually severe. Laryngeal cultures showed Staphylococcus aureus or a hemolytic streptococcus as the etiologic agent in about equal proportions. Pneumonia developed in about 50 per cent of the patients as a further complication. The author reports in detail 3 cases of measles complicated by acute laryngeal obstruction in which the patients were treated by intubation. Characteristic of this type of management is the necessity for careful nursing supervision and frequent reintubation, but this is compensated for by the infrequent occurrence of complications and by the freedom from the danger of repeated blocking, which is always present when a tracheotomy tube is used. In addition, there is no scarring of the neck, a condition of benefit to the patient in later life.

GENGENBACH, Denver. [AM. J. DIS. CHILD.]

PECULIAR COMPLICATIONS CAUSED BY A FOREIGN BODY IN THE ESOPHAGUS. P. VAN DER MEULEN, Nederl. tijdschr. v. geneesk. **84**:2639 (July 13) 1940.

A ring with two projecting points was removed from the esophagus of a girl of 5 years; it had been in that structure no less than two years, during which time there were complaints of asthma, bronchitis and laryngitis and tonsillectomy and adenotomy were performed. At extraction a perforation was produced (emphysema on the roentgenogram). Treatment was conservative. An esophagotracheal fistula developed, distinctly demonstrable with contrast material. Remarkable was the formation of new bone in front of the cervical vertebral bodies, probably as a result of periosteal irritation by the foreign body. There was an abnormality of the sixth cervical vertebra.

VAN CREVELD, Amsterdam, Netherlands [AM. J. DIS. CHILD.]

PULMONARY TUBERCULOSIS WITH PERFORATION OF TUBERCULOUS GLANDS INTO THE BRONCHI, TRACHEA AND ESOPHAGUS. P. NIEUWENHUYSE, Nederl. tijdschr. v. geneesk. **84**:4354 (Nov. 9) 1940.

In this clinical lecture a short clinical report and a more extensive pathologic description are given of an extraordinarily rapid and malign form of tuberculosis observed within a short time in 3 children of one family. Tubercle bacilli of the bovine type were found in these cases. In all 3 children the disease had a similar course. There existed extensive caseations and liquefactions with cavity formation in both lungs, and perforation of tuberculous glands into the bronchi and esophagus had taken place. The similarity of the changes in all 3 cases

probably must be explained in this way: The children were infected for the first time with tubercle bacilli, which invaded the lungs and spread along the lymph channels very quickly, owing to the malignity of the process. The cause of this malignity is sought not in the lack of immunity but in an unusual virulence of the bacilli. (See also Hoeden, J. van der: Interhuman Contagion with Bacillus Tuberculosis of the Bovine Type, *Nederl. tijdschr. v. geneesk.* **84**:4390 [Nov. 9] 1940.)

VAN CREVELD, Amsterdam, Netherlands [AM. J. DIS. CHILD.]

VALUE OF DIRECT LARYNGOSCOPY FOR TYPING PNEUMOCOCCI IN CHILDREN. J. CLAUSEN and BØRGE VAMMEN, Nord. med. **5**:5 (Jan. 6) 1940.

In 18 of 22 healthy children saprophytic pneumococci were demonstrated by the usual throat swabs, while in only 10 healthy children were they revealed by swabbing through the laryngoscope. In 23 of 26 children suffering from acute pneumonia, pneumococci were demonstrated. In 19 cases the results were identical with the two methods of swabbing, and in 3 cases swabbing through the laryngoscope rendered the more reliable result.

WALLGREN, Göteborg, Sweden [AM. J. DIS. CHILD.]

Nose

HEREDITARY HEMORRHAGIC TELANGIECTASIA. HARRY ALBAN, Northwest Med. **40**:86 (March) 1941.

The most frequent feature of this disease is nasal hemorrhage, usually beginning in early childhood, even though the telangiectasia may not become evident until the third or fourth decade. The hemorrhages may be so severe as to necessitate transfusion to save life. Laboratory procedures reveal no abnormalities except hypochromic anemia from the hemorrhages. The blood picture is entirely normal otherwise. This condition is differentiated from hemophilia on the basis of normal coagulation and its occurrence in either sex. Its differentiation from purpura and other blood dyscrasias depends on the normal blood picture.

The treatment is entirely symptomatic. Reports of the use of radium appear promising.

ROBERTSON, Omaha. [AM. J. DIS. CHILD.]

CHRONIC NASAL CATARRH IN CHILDREN. AUSTIN FURNISS, Brit. J. Phys. Med. **4**:22 (Feb.) 1941.

The author discusses sinusitis in children. Among other symptoms he mentions a paroxysmal cough, suggestive of whooping cough. He believes that roentgenographic examination constitutes a more delicate diagnostic test than puncture.

In his experience the Proetz method of displacement is especially successful in children. The principle of treatment is to apply repeated negative pressure to the nose and allow iodized oil to percolate into the sinuses. This method is particularly applicable when the sinusitis involves the ethmoid and sphenoid sinuses.

For acute sinusitis the author recommends the use of luminous heat administered directly over the face, followed by local and general actinotherapy. He resorts to surgical intervention when adequate drainage cannot be established.

HARTMAN, Cleveland. [AM. J. DIS. CHILD.]

CHRONIC HYPERPLASIA OR FOCAL OSTEITIS FIBROSA OF THE MAXILLA. E. D. D. DAVIS, Proc. Roy. Soc. Med. (Sect. Laryng.) **34**:327 (April) 1941.

A study of 26 cases seen during the past twenty-five years showed that the clinical characteristics of focal osteitis fibrosa of the maxilla were a slowly growing, painless enlargement of the alveolus of the molar region of the maxilla commencing between the ages of 10 and 25, more commonly in females. The enlargement is

smooth, solid, without signs of inflammation and without tenderness and is confined to the outer surface of the alveolus. The pathologic nature of the lesion is obscure and the claim that it arises from sepsis or toxic conditions of the teeth or a sinus cannot be substantiated. Surgical treatment should be avoided. Calcium gluconate has been tried; the consumption of milk has been increased; a soluble salt of aluminum has been given to reduce the amount of phosphorus in the intake.

CAMPBELL, Philadelphia.

EXTENSIVE NASOPHARYNGEAL FIBROMA. FRANZ C. JAHN, Bol. de los hosp. **38**:279 (June) 1939.

Jahn reports a case. The patient, a man 20 years old, presented a most critical appearance because of the extensive size and distribution of the tumor which infiltrated the nose and nasopharynx. His condition was further complicated by inability to eat, inanition and frequent profuse hemorrhages from the nose and nasopharynx, so that an extreme secondary anemia had developed.

Radical extirpation of the tumor was immediately planned. A blood transfusion was given, and a tracheotomy was done, as preliminary measures. The operative approach was by the transmaxillary, nasal and buccal routes, according to the technic of Mouré and Portmann. In addition, the velum of the soft palate was incised anteroposteriorly to permit better exposure of the operative field. With this exposure it was possible to remove the tumor mass in toto, detaching any adhesion in the nasopharyngeal space and also the prolongations of the tumor in the nasal cavity, the mouth and the sphenoid sinus. Much to the author's surprise, there was little bleeding. However, toward the close of the operation the patient became shocked and was given a transfusion of 200 cc. of whole blood. This permitted completion of the operation.

The convalescence was relatively uneventful. In its course bronchitis developed which was of a mild type and responded rapidly to treatment. Twelve days after the operation the patient was discharged, apparently cured. The pathologic diagnosis of the tumor mass was benign fibroma.

The case is presented because of (1) the extensive size of the tumor in a patient desperately sick from inanition and hemorrhage, (2) the careful preoperative preparation and postoperative care of the patient, (3) the employment of a most extensive radical procedure in an attempt to perform a mass extirpation of a tumor in its entirety and (4) the uneventful convalescence and final cure.

PERSY, Philadelphia.

BIOLOGIC THERAPY OF SINUSITIS IN INFANCY. FRANCISCO BLOTTA, Rev. méd. latino-am. **26**:167 (Nov.) 1940.

With antivirus and bacteriophage, prepared after the bacterial flora had been studied, the patients were treated topically. Local vaccination has no contraindications and can be used at any age. It did not provoke irritation or thermal response, nor is it toxic.

There was a rapid local action due to the lytic properties of the bacteriophage and the local effect of the antivirus. There was also a delayed reaction in which the stimulation of the cells of the reticuloendothelial system resulted in a specific immunity, more or less durable. When this form of vaccination does not result in complete recovery, it prepares the area for surgical intervention.

DWYER, Kansas City, Mo. [AM. J. DIS. CHILD.]

OSTEOMYELITIS OF THE FRONTAL BONE. T. MASUOKA, Bull. Nav. M. A., Japan **29**:879 (Dec.) 1940.

Osteomyelitis of cranial bones is rare, a statistical survey of 909 cases of osteomyelitis treated in the Tsukiji Charity Hospital, Tokyo, revealing only 0.22

per cent in a fifteen year period. The first patient seen by Masuoka was a girl 18 years old who had a staphylococcic infection of the frontal bone following an injury to the forehead three years previous to admission to the hospital. With local anesthesia the infected material was removed, together with two sequestrums embedded in granulomatous tissue; the patient went on to uneventful recovery. The second patient was a girl 4 years old in whom frontal osteomyelitis followed abscess formations over the upper eyelids on both sides. The suppurative process extended into the intracranial tissues, causing an abscess of the frontal lobe of the brain and leptomeningitis of the base of the brain. The patient died. The author strongly recommends early and radical removal of the infected tissues, together with such chemotherapeutic measures as administration of sulfanilamide in full doses.

J. A. M. A.

Miscellaneous

THE CHEMOTHERAPY OF STAPHYLOCOCCIC INFECTIONS. EDWIN E. OSGOOD and INEZ E. BROWNLEE, J. Pediat. **17**:740 (Dec.) 1940.

"In cultures of living human marrow infected with hemolytic or nonhemolytic Staphylococcus aureus, neoarsphenamine and sulfathiazole have proved superior to sulfanilamide and sulfapyridine. . . .

"The most desirable concentration of neoarsphenamine is 1:150,000; this corresponds to about 130 gamma of arsenic per 100 c.c. . . .

"The optimal concentration of sulfathiazole is from 5 to 10 mg. per 100 c.c., with relatively little difference in effectiveness in the lower and higher concentrations.

"In some experiments neoarsphenamine was definitely superior to sulfathiazole. In other experiments the reverse was true. The combination of the two drugs was often more effective than either alone and was always more effective than the less effective of the two used.

"Neither drug led to complete sterility of the cultures in as high a percentage of the cases as did sulfanilamide against the beta hemolytic streptococcus when similarly tested.

"The larger the inoculation of organisms, the less effective were the drugs.

"A tentative dosage plan to attain the proper blood levels of these drugs clinically is outlined.

"In a limited number of cases of serious staphylococcic infections, neoarsphenamine alone and sulfathiazole alone or the two in combination have demonstrated definite therapeutic value." AUTHORS' SUMMARY. [AM. J. DIS. CHILD.]

LOCAL APPLICATION OF RUSSELL VIPER VENOM FOR CONTROL OF HEMORRHAGE. ROBERT C. PAGE and EDMOND G. THOMAS, M. Clin. North America **24**:777 (May) 1940.

Russell viper venom appears to accelerate greatly the action of thromboplastic substances, with which it acts synergistically. It appears to be capable of reactivating such substances that have become partially inactivated by heat, aging or chemical treatment. Hemorrhage, with the probable exception of that associated with prothrombin deficiency, may be effectively and promptly controlled by local application of a 1 : 10,000 solution of the venom.

In local bleeding occurring in hemophilic subjects a tough and elastic clot is produced by application of venom by means of saturated pledgets of cotton or by drops or spray. No harmful effects have been reported to follow proper administration of the venom.

A full review and discussion of the experimental and clinical evidence on which the therapeutic application of viper venom is based appear in the paper.

EUGENE SMITH, Ogden, Utah. [AM. J. DIS. CHILD.]

SOME RECENT ADVANCES IN THE TREATMENT OF HEMOPHILIA. THOMAS H. McGAVACK, M. Clin. North America **24**:791 (May) 1940.

The development of measures effective in the control of bleeding in the hemophilic subject depends on a clearer understanding of the process of blood coagulation. This appears to be a biphasic reaction enzymic in character, concerned respectively with the formation of thrombin (thrombase) and fibrin. The present method of therapeutic approach is predicated on the apparently well formed conception that a deficiency exists in both plasma and tissue thromboplastins.

Several types of thromboplastic material, "globulin substance," have been prepared from animal and from human blood. Some of these may be of value as local applications, and those made from human blood may be given intravenously and intramuscularly. The amount of blood necessary for the preparation of the human material renders it commercially unavailable. Other disadvantages are that such a product is unstable and that repeated injections result in a refractory state, or even in actual prolongation of the coagulation time. However, euglobulin substance of Lozner and Taylor appears to be free from these disadvantages.

Extracts of human placenta have been prepared, but those thus far produced show a wide variation in effective dosage and cumulative effects with reversal of action. They also have a tendency to produce intravascular clotting. Other thromboplastic substances of tissue origin have not as yet proved satisfactory.

The ability of certain snake venoms to transform prothrombin to thrombase has been proved. The most effective seems to be that of Russell's viper, local application of a solution of which is at times effective in the control of local bleeding.

McGavack's clinical experience in the use of an extract of shepherd's purse (koagamin) has been favorable. The clot-producing properties of this extract appear to be due to its content of dicarboxylic acid. This substance may be used intravenously; it is stable and contains no protein. It would appear to be of value in the management of the actively bleeding patient.

EUGENE SMITH, Ogden, Utah. [AM. J. DIS. CHILD.]

RAISED INTRACRANIAL PRESSURE: HYDROCEPHALIC AND VASCULAR FACTORS. HUGH CAIRNS, Brit. J. Surg. **27**:275 (Oct.) 1939.

Contrary to much belief and teaching, a tumor or other mass in one part of the brain may increase the intracranial pressure locally and not disturb it generally, the limiting falx, the tentorium cerebelli and the irregular shape of the base of the skull being responsible for this condition. Consequently, decompressions to relieve localized pressure are frequently inadequate and may be dangerous rather than helpful. Decompression to produce its greatest effect should immediately overlie the tumor.

Relief of pressure at operation is of primary importance in the removal of tumors of the brain. Most surgeons welcome the welling up of cerebrospinal fluid from the depths of a wound because it is evidence that the obstruction brought about by the tumor has been relieved.

Aside from that due to an intracranial mass, increase in intracranial pressure is the result of venous congestion more often than of arterial hypertension. Cairns describes the effect of carbon dioxide inhalation on the elevation of intracranial pressure. From a normal pressure of approximately 100 mm. of water, administration of 1 per cent carbon dioxide for three minutes produced a rise in spinal fluid pressure to 125 mm.; administration of 2.5 per cent carbon dioxide for two minutes resulted in a spinal fluid pressure of 180 mm., and administration of 5 per cent carbon dioxide for two minutes resulted in a spinal fluid pressure of 320 mm.

Cairns cites several cases in which the brain obviously began to swell at operation as a result of the administration of carbon dioxide. In 1 case hemorrhage occurred into a tumor and death resulted; in another severe edema and engorgment of cerebral veins around a tumor took place.

STUCK, Denver. [ARCH. NEUROL. & PSYCHIAT.]

USE OF PLASMA OR SERUM AS SUBSTITUTE FOR WHOLE BLOOD. C. H. BEST and D. Y. SOLANDT, Brit. M. J. **2**:116 (July 27) 1940.

The authors state that there is considerable uncertainty about the relative merits of serum and plasma as substitutes for whole blood in various clinics. They state that in their recent experimental work on animals serum and plasma were used interchangeably and the results were identical. These materials are used both experimentally and clinically for two main purposes: first, to provide fluid and, secondly, to provide the serum proteins, which by their osmotic pressure retain fluid in the blood stream or attract it from the tissues. They state that so far as these two properties are concerned there is no significant difference between the serum and the plasma. They say it can now be safely stated that normal serum, concentrated serum and serum reconstituted after drying in a frozen state have been used in treatment in many clinical cases without the occurrence of any serious reaction. The main point they wish to bring out in their article is "that plasma and serum free from reaction-producing substances are physiologically and therapeutically identical and may be used interchangeably."

ROYSTER, University, Va. [AM. J. DIS. CHILD.]

MENINGIOMA OF THE FRONTO-ORBITAL REGION. J. SANTA CECELIA and P. ELEJALDE, Ophthalmos **1**:9, 1939.

A case of meningioma of the fronto-orbital region in an 18 year old girl is presented. The tumor involved the frontal region, the base of the nose and the lower lids and was accompanied with exophthalmos and advanced optic nerve atrophy. Roentgen examination revealed destruction of bone in the areas involved. The patient died of intercurrent pneumococcic meningitis. Necropsy disclosed considerable destruction of the frontal and other bones comprising the upper part of the face and of the anterior base of the skull by the tumor mass, which was pasty in consistency, with a harder central core. From the histologic standpoint, the greater part of the tumor consisted of endothelial-like cells somewhat elongated and arranged irregularly in certain areas, while in others they showed a tendency to tubular formations. A diagnosis of meningioma omniformis and acute purulent meningitis was made.

The authors discuss at length the different classifications of meningeal tumors and adopt the recent one proposed by Globus.

The article is illustrated.

MONTALVÁN. [ARCH. OPHTH.]

GLOSSOPHARYNGEAL AND TRIGEMINAL NEURALGIA AND ITS TREATMENT WITH SNAKE VENOM. W. BEHRMANN, Deutsche med. Wchnschr. **66**:817 (July 26) 1940.

Behrmann knows of no systematic investigations on the use of snake venom in the treatment of neuralgias in the region of the face and head. He reports 3 cases of his own in which he resorted to this treatment. The first patient, a woman aged 54, for five months had suffered from severe pains in the tongue. Lightning-like extreme pains were felt first after eating and later when opening the mouth or speaking. Several weeks later peculiar taste sensations were experienced. The swallowing of dry foods became painful and later impossible. Treatment with various analgesics and with nonspecific vaccine therapy was ineffective. Snake venom, in the amount of 0.25 cc., was injected deep into the muscle. This dose was increased after an interval of three days to 0.5 cc. and later to 1 cc. Injections of 1 cc. of the venom were administered once or twice weekly. After three weeks of treatment the patient was entirely free from pain, and her general appearance was greatly improved. She gained in weight and has remained free from pain for over a year. The second patient had trigeminal neuralgia. Ten injections of snake venom produced complete freedom from pain. In the third patient with trigeminal neuralgia the effect of snake venom therapy

was not so favorable. This woman, however, had leontiasis ossea, and the anatomic changes in the cranial bones were responsible for the neuralgia. In the other 2 patients there existed general and cerebral arteriosclerosis. Arteriosclerotic neuritis is especially likely to develop in the trigeminal nerve because its root area has few vessels and is exposed to pontile circulatory disturbances. Snake venom, in addition to the analgesic action, possesses cytolytic and proteolytic effects on the vascular endothelium. It reduces blood pressure, produces a more favorable circulatory state, increases the metabolism of the nerves and counteracts the neuralgic pain.

J. A. M. A.

Society Transactions

AMERICAN LARYNGOLOGICAL ASSOCIATION

WILLIAM E. GROVE, M.D., *Editor of Abstracts*

Sixty-Fourth Annual Congress, Atlantic City, N. J., May 25-27, 1942

Ludwig's Angina. DR. C. H. MCCASKEY, Indianapolis

This paper appears in full in this issue of the ARCHIVES, page 467.

DISCUSSION

DR. HENRY B. ORTON, Newark, N. J.: I shall demonstrate by slides what Dr. McCaskey has described, namely, the pull of the various muscles on the floor of the mouth and of the tongue.

The digastric muscle pulls the mandible out, and if it is fixed at the mandible, it elevates the hyoid bone. The mylohyoid muscle has a tendency to pull upward, the hyoglossus downward, the styloglossus upward, the stylohyoid upward, and the masseter muscle, below the level of the mylohyoid, downward.

The geniohyoid muscle has a double action. Normally it elevates and pulls the hyoid bone forward, but if it is fixed, it depresses the mandible; so the geniohyoid and the digastric exert a pincer movement. The geniohyoglossus muscle has a three movement action. The posterior portion protrudes the tongue; the anterior portion pulls it back, and all of the musculature of the geniohyoglossus pulling together depresses the tongue.

In the case of suprahyoid compression, which is present in Ludwig's angina, the tongue is pushed up against the soft palate, the soft part of the uvula against the pharynx, the base of the tongue against the epiglottis and the epiglottis back to the pharynx. This is the danger zone in Ludwig's angina.

A slide illustrates the incision Dr. McCaskey spoke of. It is made underneath the jaw and passes through not only the geniohyoid and the mylohyoid muscle but the digastric as well, thereby releasing the tension and possibly eliminating future trouble.

DR. THOMAS E. CARMODY, Denver: There is one point to which I wish to call attention. Dr. McCaskey said that infection seldom goes through the gingival margin. I had a case a few years ago in which osteomyelitis, following cleaning of the teeth, broke the soft periosteum at the gingival margin and produced infection of the mandible. Later true Ludwig's angina developed. I have seen several cases of that kind in which infection followed an injury. Dr. McCaskey spoke of them. Most of the injuries are due to fractures, and the infection occurs on the inside of the mandible. Dr. McCaskey stated that the infection seldom perforates the external surface of the mandible. Because the mandible is much thinner on its inner surface, the infection drains easily to the lingual surface and the submaxillary region, where true Ludwig's angina is established.

DR. SAMUEL IGLAUER, Cincinnati: Dr. Carmody has stressed the importance of the history. It so happens that I became interested in Ludwig and found an account of his life, that is, his surgical life. It seems that when Napoleon invaded Russia, Ludwig had joined his army and got as far as Smolensk, where he was captured by the Russians. He became ill there and probably had typhus fever. He finally was released or exchanged and got back to Stuttgart, Germany, where he recovered. Later on, when Great Britain and Germany lined up against Napoleon, he joined the German army and took part in the campaign against Napoleon, with whom he had originally been associated.

There are one or two points about Dr. McCaskey's paper I cannot quite understand. Why does he have to ligate the facial artery as a preliminary? It was my impression that one is working under the jaw and does not particularly come into relation with the facial artery.

Another thing I should like to question is the bisection of the geniohyoid muscle. I think Blair (Diseases of the Mouth and Jaws, St. Louis, C. V. Mosby Company, 1912, p. 338) pointed out that it is dangerous to cut one or both of these muscles because they hold the tongue forward; if one severed the geniohyoid completely, the hyoid bone would tend to fall back and aggravate the condition which Dr. Orton has described.

I should also like to ask Dr. McCaskey whether he thinks that this infection, as a rule, is chiefly under or above the mylohyoid muscle. It seems to me there are two conditions: one in which the abscess is above the diaphragm of the mylohyoid muscle, which might be called a sublingual abscess, and one which is below the mylohyoid, or true Ludwig's angina.

I might say, furthermore, that Ludwig had good opportunities to study the pathology of this disease at autopsy, for in his day the patients were treated chiefly by poultices and most of them died.

Dr. Blassingame has had Ludwig's original article translated, and he sent it to me. I should like to hear from him on this subject.

Dr. Charles D. Blassingame, Memphis, Tenn.: The important thing about Ludwig's angina is its true classification.

In the case that Ludwig described, and on which the entity is based, the infection was above the mylohyoid muscle and pushed the tongue up to the roof of the mouth. The abscess ruptured inside the mouth, and the patient recovered without any operation. As I understand it, such an abscess is a different condition from infection below the mylohyoid muscle. With the latter one does not have elevation of the tongue. The reason the death rate is still stated as 50 per cent is that no distinction is made between those cases in which the infection is below and those in which it is above the mylohyoid muscle.

If the tongue is raised, the infection is inside the floor of the mouth, above the mylohyoid muscle, and, as I understand it, that is the type which Ludwig described. If the infection is below the mylohyoid muscle, any surgeon can treat the condition adequately. If it is above the mylohyoid and the surgeon does not cut through the floor of the mouth, the patient will die unless the abscess ruptures, as in Ludwig's case.

I think the factor of greatest importance in Ludwig's angina is that of pressure necrosis. The amount of pressure which can be generated by an infection inside the floor of the mouth is tremendous. I recall a patient who died of asphyxiation when the infection in the floor of the mouth generated enough pressure to push the tongue against the posterior wall of the pharynx. Much pressure, if confined, will cause necrosis, and that is what happens in this disease, as Dr. McCaskey has clearly brought out. The chief point in treatment is wide incision to relieve the pressure soon, before necrosis takes place.

I recently had a case in which there was an area of infection in the floor of the mouth under the tongue which I was draining. I thought I was getting adequate drainage from this area, but the infection spread over the border of the mylohyoid muscle and formed a lateral pharyngeal abscess. Then the swelling started to extend down the neck. This required an external incision, after which the infection in the neck cleared up. The infection under the tongue, however, continued to drain pus profusely about six days longer, when a large mass of necrotic tissue was expelled from under the tongue. On the following day pus was no longer present, and the patient promptly recovered. So I think the distinguishing characteristic of Ludwig's angina, as differentiated from other abscesses of the neck, is the pressure necrosis.

Dr. Francis L. Weille, Boston: I should like to call attention to Mosher's technic for incision in a case of this kind—one which will drain the tissues both

in the neck and in the floor of the mouth. His classic incision is made medial to the submaxillary gland and avoids touching the artery in the floor of the mouth. The area can thus be drained from the side.

Dr. T. C. Galloway, Evanston, Ill.: In these cases of Ludwig's angina emphasis has been placed on the anatomic factors rather than on the infecting organism.

In Ludwig's angina the fascial limitations have been considered most important; yet is it not possible that anaerobes from the mouth determine to a great extent the nature of the process? The anatomic factor, of course, is important, as Dr. Blassingame has shown, because in the region of the floor of the mouth the inflammatory swelling of the primary invasion shuts off the circulation and provides anaerobic conditions optimal for the spread of these particular organisms. Also, the cure is brought about by wide incision, which does not especially provide good drainage for a relatively unlocalized infection, but rather releases tension, restores circulation and allows the access of air to the infected territory. The organism of Vincent is of special importance.

Dr. George B. Wood, Philadelphia: I thought all believed that Ludwig's angina is simple cellutitis of the floor of the mouth and entirely differentiated from any abscess concerned with the submaxillary gland or the lymphatics of the neck.

It has been repeatedly said that the buccinator, the geniohyoid and the genioglossus muscle make a barrier against the spread of infection from the floor of the mouth into the neck. It is easy to make a differential diagnosis clinically between phlegmonous cellulitis of the mouth, or simply inflammation of the submaxillary gland and, say, a calculus by palpation of the floor of the mouth with the finger and by the presence of elevation of the tongue.

It was my conception that the term Ludwig's angina was limited entirely to a phlegmonous cellulitis of the floor of the mouth which occurs in the fascial space between the geniohyoid and the genioglossus muscle. Further, the asphyxiation in cases of this condition comes not so much from the elevation of the tongue as from edema of the glottis. The infection spreads posteriorly and between the genioglossus and the geniohyoid muscle directly back to the base of the epiglottis, where it soon produces edema of the glottis itself.

In the cases which I have seen—they have not been many—when the asphyxia became severe the patient was distinctly hoarse, as one would expect from the edema of the glottis.

I think that the operative aspect has been well considered. Dr. Mosher's operation of turning up the submaxillary gland to reach the floor of the mouth is scientifically developed without doubt, but it is easier for me to make a frontal incision. If one limits that incision from one facial artery to the other, one will have plenty of space and will not have bleeding of any amount. One can get directly into the floor of the mouth by cutting one of the geniohyoid muscles. One may also have to notch the anterior border of the mylohyoid muscle.

Dr. John F. Barnhill, Miami, Fla.: Why does one need to cut the geniohyoid muscle?

Dr. George B. Wood, Philadelphia: To get sufficient space to relieve tension, which is absolutely necessary. If there is much tension, I think tracheotomy should precede the operation.

I was put in a great dilemma in a case in which I operated a number of years ago by having to do an emergency tracheotomy through a swollen, edematous neck because the patient stopped breathing when I started to open the abscess.

I wish to point out that an abscess originating from the third molar tooth will not produce Ludwig's angina because it is back of the hyoglossus muscle.

The hyoglossus muscle lies in a plane in front of the second molar tooth, and in order to get a phlegmon in the floor of the mouth the rupture of the tooth must be in front of the hyoglossus muscle.

DR. HARRIS P. MOSHER, Marblehead, Mass.: When pus becomes rampant in the neck, it does not, in my opinion, pay much attention to fascial demarcations.

The greatest satisfaction I have had in dealing with cases of this infection—and in most of mine it has not been of dental origin—has been when I made a liberal incision on the side of the neck, to get under the submaxillary gland, which gives me control of the side of the tongue. I have a suspicion, which some one who is not so obsessed with the anatomy and the fascial limitations may sometime prove to be true or false, that some of these abscesses are frankly in the base of the tongue or are outside the tonsil, in the pharyngomaxillary space. In some cases I went into a pocket, either at the base of the tongue or outside the tonsil, and I feel that there are more of those than have been put on record

DR. C. H. MCCASKEY, Indianapolis: I believe I said at the beginning that this type of Ludwig's angina is a true, purulent lymphadenitis. There is, then, just one thing to do, that is, to get free and unlimited drainage.

In some cases one finds no pus but there is a tremendous outpouring of lymph after the incision, and that seems in some way to limit the tension.

If one waits until one finds free pus, the stage is much later and more dangerous, and there is more likelihood of septicemia.

I read Dr. Blassingame's article (Angioma Ludovici: An Anatomical and Clinical Study, ARCH. OTOLARYNG. **8**:159 [Aug.] 1928) two or three times. I think he has a keen conception of the condition, but it is my experience that one sees the cases of this condition late, not very late, but when there is tremendous tension pushing up the tongue and spreading the infection along the floor of the mouth. By doing a so-called decompression of the neck there is some chance of saving the patient.

Dr. Mosher says he likes free and liberal drainage, as I do. I think the question of cutting the geniohyoid muscle has been answered.

Infections with Anaerobic Streptococci, with Special Reference to Cranial Osteomyelitis. DR. THOMAS C. GALLOWAY, Evanston, Ill.

This paper appears in full in this issue of the ARCHIVES, page 514.

DISCUSSION

DR. E. D. KING, Cincinnati: Last September I performed an antrum window operation on a physician and friend, about 35, who had had chronic suppurating sinusitis. He had been advised at various times to have a radical operation on the antrum but had finally compromised on a window operation. About ten days after operation he had a swelling of the right side of his face at the corner of the nose. This I had under observation for about ten days. I told him it would be all right. At the meeting of the American Academy of Ophthalmology and Otolaryngology in Chicago I discussed this case with Dr. Galloway, and he described 2 or 3 similar cases and their treatment. But I could not persuade any of the men who were called into consultation to make an incision in that area because surgeons and otolaryngologists are loath to make an incision in that area of the nose. The swelling was characteristic, and, as Dr. Galloway has described, it was indurated. It felt as though it was subperiosteal. Finally, after a month, when pressure made an opening, I could see the fistula, from which pus was observed to be exuding. The patient, after tremendous cellulitis of the face had developed, was persuaded to have the incision made, which was done with the cautery knife. A Shaw lateral rhinotomy was performed; a large amount of pus was removed. There was no osteomyelitis, but bare bone could be felt with the probe. From then on the course was tragic. Osteomyelitis of the nasal bones and septum and of the frontal bone and, finally, subdural and cerebral abscess developed. He died two months later.

During all this time the surgeons were loath to make any incision, but, finally, about six weeks after the original incision, when osteomyelitis could be demonstrated on the roentgenogram, an incision was made up through the center, the flaps were laid out and zinc peroxide was used, but by this time a subdural abscess had developed.

The bacteriologic observations may be of interest. Dr. W. A. Altmaier, surgical bacteriologist at the Cincinnati General Hospital, sent me this note the other day: "We believe the responsible infecting agent was a microaerophilic hemolytic streptococcus, which grew only anaerobically at first, but after repeated subcultures became slightly aerobic."

That such an organism is known Dr. Galloway has already stated. There was no difficulty in isolating this bacterium repeatedly during the course of the illness.

As Dr. Galloway advised, sulfonamide compounds were given in tremendous doses, and one of the bacteriologists grew the organisms in the presence of these drugs in the medium.

What impressed me most about this case was the unwillingness of the surgeons and those who were called into consultation to make an incision and the ineffectiveness of the sulfonamide drugs in treatment.

DR. V. V. WOOD, St. Louis: May I ask Dr. Galloway in how many cases there was maxillary or sphenomaxillary trauma?

DR. THOMAS C. GALLOWAY, Evanston, Ill.: In 3 in that series.

DR. V. V. WOOD, St. Louis: I am not asking this question to be critical, for all know how patients with rare conditions will flock to one, but might it not be possible that in cases of this type an acute exacerbation might occur as a result of trauma?

DR. HARRIS P. MOSHER, Marblehead, Mass.: I cannot let this paper pass without a comment. It was splendidly prepared and delivered. This seems to be the age of miracles. The sulfonamide drugs came in and produced their miracles, and now I am wondering whether the anaerobe-specific drugs, if dealt with properly, are not going to join their class.

I cannot understand the surgeons being unwilling to make an incision in the presence of infection. Ever since Williams published his article, I have been interested in this subject and have followed it up a bit, but not to the extent that Dr. Galloway has. He has given me a good deal of new information.

In a case of fulminating osteomyelitis which Dr. Shaw had recently, only a third culture produced an anaerobic streptococcus. Dr. Galloway says one must get at the center of the sequestrum to find the organism. That makes the procedure difficult. The whole bacteriology of infections with the anaerobic class of organisms seems to me confused. Laboratories will have to learn a bit of new technic before one can be sure whether one has such an organism or not.

I have not seen many cases of subperiosteal involvement, although a subperiosteal abscess is commonly associated with ordinary fulminating osteomyelitis. Did I understand Dr. Galloway to say that in 1 of his cases he went down to the periosteum, found pus under it and made no opening in the bone, but contented himself with the local use of zinc peroxide as far as he could uncover the bone? For me it might complicate the procedure to follow the periosteum to its limit of denudation, so to speak, and get the drug in.

DR. HOWARD C. BALLENGER, Winnetka, Ill.: Since Meleney's work (Meleney, F. L.: *U. S. Nav. M. Bull.* **40**:53 [Jan.] 1942), many other authors and investigators have emphasized three points about the use of zinc peroxide: First, the preparation must be fresh; second, it is usually used in aqueous solution and must be in contact with all infected parts, which, of course, means that a complete surgical excision or exposure must be made, and third, the dressing must be kept wet. I understand a preparation is now on the market which is ready to use; that is, it is sterilized by dry heat.

Work has been cited (Reed, G. B., and Orr, J. H.: Treatment of Experimental Gas Gangrene with Zinc Peroxide, *War Med.* **2**:79 [Jan.] 1942) in which ten times the lethal dose of these anaerobes was injected into guinea pigs and then zinc peroxide was used, with good results, but sulfathiazole (2-[paraaminobenzenesulfonamido]-thiazole) was used locally with about the same results. So it seems these two drugs can be combined, perhaps with value.

I believe no results were obtained by inoculation, but the local use of the drugs did give results. Other derivatives of sulfanilamide apparently had no effect (Reed, G. B., and Orr, J. H.: Local Chemotherapy of Experimental Gas Gangrene, *War Med.* **2**:59 [Jan.] 1942).

DR. THOMAS E. CARMODY, Denver: My associates and I have found in cases of abscess of the jaw just what Dr. Galloway has called attention to, namely, the presence of the infection under the periosteum, as well as along the arteries. For instance, we find it under both the external and the internal periosteum, and there is no reason that we should not find it in other places.

Also, in many cases of these abscesses of the jaw we have the problem of culture of anaerobic organisms.

DR. THOMAS C. GALLOWAY, Evanston, Ill.: Dr. King's case was interesting, and, in discussing it, I rather predicted the outcome if he was not allowed to operate.

Mackenzie (*J. Laryng. & Otol.* **42**:293 [May] 1927) said that in treating these infections of the maxilla one should make a moat so that the infection cannot get across into the frontal area; if one did that it would probably protect against any advance of the infection.

Dr. Wood asked about trauma. I think trauma is important. One should remember that it is not the wide incision of a radical operation on the frontal sinus that produces the trouble, but rather the minor operation, which does not expose the organism or the infection to aerobic conditions.

In traumatization, local death of tissue and destruction of some blood vessels are produced, and that is the condition under which anaerobic infection can begin and advance.

Now, as to the question of periosteal extension, I am inclined to think that the process is likely to progress under the periosteum at the very advancing border of the lesion.

In my case of a necrotic lesion I found that only by making a lateral rhinotomy incision could I get the organisms from under the periosteum. There are several ways of culturing these organisms. Cultures may be obtained from the advancing border of the lesion or from the interior of the sequestrum.

It has been shown in cases of mixed infection of the skin that if one draws pus into a pipet and allows the pus to stand for several hours, the staphylococci will die and the anaerobic streptococci will multiply without being overgrown by the staphylococci. There are many technics for obtaining the organisms.

Dr. Mosher has always emphasized the importance of wide exposure. That is the first prerequisite, and, if perfectly done, probably nothing further is necessary in the treatment of these infections.

The case I mentioned was my first one. I was a little fearful of what I should do. I was ready to go ahead with radical operation if my treatment did not succeed.

There is one advantage in having a pocketed wound. One can put in a tube and irrigate with the zinc peroxide solution.

I infer that Dr. Ballenger speaks of war surgery. I think that the use of sulfathiazole under aerobic conditions is effective.

Chemotherapy of Diseases of the Nose and Throat. DR. DANIEL S. CUNNING, New York.

The status of the sulfonamide drugs is changing so rapidly that new and improved combinations are being produced and tried continually. It is now over

seven years since the introduction of the sulfonamide group of drugs to the realm of medical and surgical practice. In 1936, sulfanilamide, the first of the sulfonamide group to be employed as a chemotherapeutic agent, was introduced; it acted as a specific against hemolytic streptococci. Since then no less than eighteen of the sulfonamide drugs have been introduced. In 1938 sulfathiazole was introduced to the medical profession; this drug worked well with streptococci, pneumococci and staphylococci. In 1939 sulfapyridine (2-[paraaminobenzenesulfonamido]-pyridine) was introduced, and this drug acted miraculously on pneumococci, on which sulfanilamide had little effect. In 1940 sulfadiazine (2-[paraaminobenzenesulfonamido]-pyrimidine) was produced, and this drug seemed to act well on practically all organisms and proved itself to be the least toxic of commonly used sulfonamide compounds. This is the drug of choice at present, and seems to be just as effective against all the organisms as the preceding sulfonamide compounds which were supposedly specific.

The sulfonamide drugs have been a great boon to otolaryngologists in the treatment of all severe infections of the nose and throat, such as deep infection of the neck, suppurative sinusitis, erysipelas, thrombosis of the cavernous sinus, Ludwig's angina, laryngotracheal bronchitis, edema of the larynx and meningitis. While it must be remembered that these drugs are a great help in combating such infections, they must not be depended on to take the place of surgical treatment; rather they act as a valuable adjunct to surgery.

All physicians prescribing sulfonamide drugs should be familiar with the toxic reactions that may follow their use, such as hematuria, renal colic, formation of calculi and agranulocytosis.

Only 10 per cent of all patients receiving these drugs show any toxic manifestations; so in cases of severe infection one should not fear the toxicity too much but give the drug boldly and in large doses early in the infection.

DISCUSSION

DR. SAMUEL SALINGER, Chicago: There are instances in which the reaction of the drug may cause some confusion in diagnosis. I shall describe a case in point: A patient with external suppuration over the nose following a nasal fracture was given sulfathiazole and at the end of two days had chills and elevation of temperature. Having had a similar experience after the administration of sulfathiazole in a case of meningitis, I discontinued the drug, but the chills and fever persisted. Despite the negative results of blood culture, I placed the patient under treatment with sulfadiazine, and within twenty-four hours I obtained a satisfactory result.

In the hospital with which I am associated there have been 3 cases in which repeated chills and fever followed the administration of sulfathiazole. These symptoms subsided when the drug was withdrawn.

DR. FRANK R. SPENCER, Boulder, Colo.: I wish to emphasize three points about sulfadiazine: First in relatively small doses it gives good results. I have been using sulfadiazine for some time in the treatment of many kinds of infection, not infections which promised to be severe or alarming, and I have obtained much quicker results than I would without the drug. Second, I get early a high concentration in the blood, as Dr. Cunning has mentioned. Third, the drug is not very toxic; so I use it routinely in many cases of infection in which I would not have given any of the sulfonamide drugs six months or a year or two ago.

DR. SAMUEL IGLAUER, Cincinnati: Dr. L. H. Schmidt and his associates (Studies on Sulfonamide-Resistant Organisms, *J. Pharmacol. & Exper. Therap.* **74**:175, 1942), of Cincinnati, have shown that sometimes these organisms become resistant to the drug. They have found that in a certain percentage of cases the organism, when isolated from a patient who has been treated with one of the sulfonamide drugs, will grow in vitro in the presence of the drug. So when one does not get a therapeutic effect, it may be that the organism has become resistant to the drug and that the drug will have no further effect.

Schmidt thinks that once an organism becomes resistant, subsequent cultures of that organism remain resistant, and he worries a little about spreading around the community a strain of the streptococcus which is not susceptible to the drug.

DR. CLAUDE C. CODY JR., Houston, Texas: Dr. Cunning mentioned the local effect of the drug. Of course, the drug has a systemic bacteriostatic action. It likewise has an antiseptic effect when used locally, but then there is an analgesic effect, in addition to the bacteriostatic and antiseptic action.

It can be used locally in cases of laryngectomy and it will cut down primary infection considerably. In addition, it contributes greatly to the comfort of the patient, as is also true after mastoidectomy. Also, in the treatment of the more or less serious conditions, such as acute follicular tonsillitis, it will reduce the length of the illness and will contribute greatly to the comfort of the patient.

As Dr. Imperatori has already pointed out, it does not seem to have quite the same beneficial effect in the nose. The 5 per cent solution of sodium sulfathiazole does cause irritation of the mucous membrane of the nose.

I have not been able to see that the sulfonamide drugs have any particular effect on acute maxillary sinusitis or on the common cold. But in a number of cases of chronic maxillary sinusitis, especially those in which there is a bad odor, I have had the condition clear up by simply irrigating with a solution of sulfathiazole. I am not prepared to say whether such results were accidental or coincidental, but in cases of foul maxillary sinusitis it is worth while using the irrigation for several treatments.

Will Dr. Cunning state whether he has noticed, as I seem to have done, that the patient who has received one of the sulfonamide drugs is more liable to a reaction if he is later given a blood transfusion?

I have also noticed that in typing a patient's blood for a blood transfusion I cannot depend on the customary period of thirty minutes, but find that it is necessary to wait an hour in order to see whether there is any agglutination or lysis. Also, there is now ample evidence from the work of a number of internists, particularly in laboratories, that the sulfonamide drugs do not have any effect on immunity. They neither shorten nor lengthen it. In cases of severe infection it is well to continue the use of the drug until immunity would naturally occur, for if one does not one can expect recurrence of the disease before the natural immunity develops to protect the patient.

DR. GEORGE B. WOOD, Philadelphia: I should like to ask Dr. Cunning how seriously irritating are the sodium salts of sulfathiazole to the mucosa of the antrum or of the nose. In an article recently published in *The Journal of the American Medical Association* experiments on animals were described which showed that the necrotizing effect of the sodium salts was severe. The author thought it was due to the alkalinity.

DR. BURT R. SHURLY, Detroit: I have found that sulfadiazine is the favorite of all the sulfonamide drugs, and I should like to ask whether Dr. Cunning's experience coincides with the observation that large doses in the beginning are much more valuable than small continuous doses, and whether the symptoms will light up again unless the drug is used for a long period?

DR. D. S. CUNNING, New York: In answer to the question about the effect of sulfadiazine in cases of blood transfusion, I do not know about the typing. That is done in the laboratory department, but I do know that practically all the patients with meningitis have several transfusions while they are receiving large doses of one of the sulfanilamide drugs, and if there were any discrepancy I should certainly hear about it from the laboratory.

Hereditary Hemorrhagic Telangiectasia. DR. FREDERICK A. FIGI, Rochester, Minn.

The observations recorded in this communication are based on experience with 20 cases of hereditary hemorrhagic telangiectasia. Epistaxis was the presenting complaint in all the cases, and without exception this originated from telangiec-

tases in the nasal mucous membrane. All of the patients presented similar lesions in other situations, particularly about the face, lips, tongue, neck, chest and finger tips, but only in a few instances did bleeding occur from these areas, and then it was not of serious moment. Only local measures were found to be of value in controlling the nasal hemorrhages. Electrocoagulation proved to be most effective in this regard. Snake venom was of little benefit.

DISCUSSION

Dr. John J. Shea, Memphis, Tenn.: I have a patient with such a lesion. His mother has had the condition, to my knowledge, for thirty years, and the disturbance is also present in a niece.

In the older books the condition is classified as Osler's disease. It is certainly a disease of the capillaries.

The clotting time of the blood may be normal, and nothing which affects the thrombokinase or the calcium element seems to have any influence.

Alcohol is harmful to patients with this disorder. Every time my patient starts to drink the least bit consistently he has a series of nosebleeds. Epinephrine, by its local action on the capillaries, controls the bleeding immediately, but only as long as its action lasts. Radium gives the longest relief of any of the local applications, but its use is limited. Of the forms of coagulation, the ordinary electrical method is satisfactory, but diathermy coagulation seems to be better than the ordinary type because it operates more deeply.

These patients apparently have a vitamin C deficiency. This is the only vitamin which enters the question, and it is a good thing to keep up vitamin C therapy. For the anemias the liver extracts seem to be better than either copper or iron, and I have had no success in the treatment of telangiectasia with snake venom. After all, it is truly a question of controlling bleeding from diseased capillaries.

Dr. Daniel S. Cunning, New York: I had a case in which the diagnosis was a little doubtful. The patient was hypertensive and had about six lesions in the nose. I was able to control the bleeding with a sclerosing solution. Have you used sclerosing solutions, Dr. Figi?

Dr. Francis L. Weille, Boston: Because this disease seems rare, I should like to describe a case which I encountered during my last service at the Massachusetts Eye and Ear Infirmary. The patient had been bleeding intermittently for a number of weeks. After listening to this paper, my hair almost stood on end when I realized the diagnosis had been made by biopsy. In taking the specimen the blood spurted from side to side. However, the diagnosis was made, the nose was full of crusts, with a big hole in the septum, and the patient bleeding; what was going to be done about it? After a great deal of effort I found that the bleeding was coming from the left lateral wall of the nose; so it was decided to ligate the external carotid artery just below the ascending pharyngeal branch. Bleeding stopped for awhile and started again, and then I ligated the ethmoid arteries. That checked the hemorrhage, and it had not recurred at the end of about three months, when I last heard from the patient.

Dr. Charles Imperatori, New York: In my whole career I recall 4 patients with hereditary telangiectasia of the nose. Of these 4 patients, 1 died and the other 3 are still alive. One patient I saw a month ago, and I assured him that I should have something new with which to help him after I heard Dr. Figi's paper. As Dr. Figi has recommended, I must continue as I have in the past, that is, to use the diathermy current. In this particular case, after destruction of the tissue by diathermy, there will be a regrowth in a different place within a month; in fact, at times these little telangiectatic spots recur in the coagulated area.

The thing that has controlled this patient's bleeding as much as anything—I mean for the time being—is cotton impregnated with tannic and gallic acid. He inserts this into his nostrils loosely, and within two or three minutes the bleeding ceases.

I did a submucous resection on every one of these 4 patients, particularly the last one, and the operation stopped the bleeding because it was mostly over the septum, but now practically all the telangiectatic spots are on the turbinates.

There is a preparation known as stryphnon (methylaminoacetoorthodioxybenzene) which I instructed 2 of these patients to blow or aspirate into the nose. To do this, the patient takes a paper straw, sticks it into the stryphnon powder, puts the straw into the nose and inhales and the straw acts as a powder horn.

DR. GORDON BERRY, Worcester, Mass.: May I ask whether there is any limit to the time during which electrocoagulation can properly be employed?

DR. ARTHUR W. PROETZ, St. Louis: In Dr. Figi's opinion, has the occurrence of new lesions anything to do with the procedure which is used to stop the old ones, or will they occur in the natural course of events?

DR. GEORGE B. WOOD, Philadelphia: With regard to ethmoid bleeding, I have in mind a patient, not one with hereditary telangiectasia, but one who had a bleeding spot on the septum in Kiesselbach's area, to control which I tried cautery, chromic acid and partial resection. I elevated the mucous membrane on one side but did not take out the cartilage. This stopped the bleeding for seven days. The patient came into the office one day and said I had done a fine operation. I touched the spot with an applicator, and the blood spurted out. Without letting the patient see the blood, I put cotton in and cut above the lesion so as to sever the descending branch of the ethmoid artery, and she never had another hemorrhage. I had cut the nasal branch which comes down on the septum from the anterior ethmoid artery.

DR. FREDERICK A. FIGI, Rochester, Minn.: As Dr. Shea has stated, the disease was formerly referred to as Osler's disease. In fact, Osler was one of the first to describe it, though not the first. It had previously been described by Rendu, a Frenchman (*Bull. et mém. Soc. méd. d. hôp. de Paris* **13**:731-733 [Oct.] 1896), and not infrequently the disease is referred to as the Osler-Rendu syndrome. In recent years, Goldstein has attached his name to the disease because he reported several cases.

As regards radium, my associates and I have employed it somewhat, but we have been trying to avoid its use because it produces dryness, crusting and atrophy of the mucous membrane later; then, after some years, if the dose has been high there is secondary telangiectasis from the radium itself. This, in my opinion, has tended to increase the tendency to bleed, rather than to decrease it.

What Dr. Shea said concerning the effect of alcohol in increasing the tendency to bleed seems logical, since alcohol is a vasodilator, especially on the body surface. I was not aware of the deficiency of vitamin C in this connection.

I have not employed sclerosing solutions in the management of this condition. I use them commonly in treating angiomas, especially those of the cavernous type. Recently I have been using them to some extent for capillary angiomas. I should think one would experience considerable difficulty, however, in injecting the sclerosing solution at the site where it would be of value, for most such solutions should be injected intravenously in order to be effective.

Submucous resection is commonly employed as a therapeutic measure in this connection. The procedure sounds illogical, but, as has been stated, patients with this condition do not have a prolonged bleeding time. They stand general surgical treatment quite as well as a normal person. There is no difficulty with the coagulation of the blood. The defect is in the walls of the superficial capillaries and venules, many of which consist only of a single layer of endothelial cells with a greatly thinned mucosa stretched over it.

Biopsy should occasion no particular difficulty, except that there might be active bleeding, especially if one happened to strike the site of one of the lesions. I see no contraindication to submucous resection, especially since it can usually be carried out without difficulty.

Concerning the time limit for electrocoagulation about which Dr. Berry inquired, I do not think there is any. It is largely a matter of the patient's tolerance. Personally, I have on more than one occasion electrically coagulated

these lesions in from one and one-half to two hours, except for the periods in which I had to stop to recocainize the area. Bleeding would occur at new areas or around the periphery of the crust which the coagulation produced, and it was only by intensive electrocoagulation that the hemorrhage could finally be stopped.

I feared that saddle back deformities of the nose would result in some of our cases. To date, I have not seen any.

In answer to Dr. Proetz, the lesions tend to become more numerous even when no treatment is carried out. Even though the lesions which are present are completely sclerosed by electrocoagulation, or whatever agent one may use, the new lesions which would otherwise occur develop and require the same treatment which would have been necessary without it.

External Deformities of the Nose and Methods Used in Their Repair. DR. WARREN B. DAVIS, Philadelphia.

This paper will appear in a future issue of the ARCHIVES.

Laryngotracheobronchitis in Children: Classification and Differential Diagnosis. DR. T. ROY GITTINS, Sioux City, Iowa.

This paper appears in full in this issue of the ARCHIVES, page 491.

DISCUSSION

DR. FRANK R. SPENCER, Boulder, Colo.: Each year I have occasion to see many children with acute laryngitis or acute laryngotracheobronchitis at the University of Colorado Hospital. In few cases is the infection mild; that is, one does not get the mild forms of the disease, but rather the severe ones. Many patients are almost moribund when they are admitted. Certain features of this disease should be emphasized.

The tracheobronchial secretions are so dry and tenacious that it is impossible for the patient to expel them by coughing.

Last year, before the Section on Laryngology, Otology and Rhinology of the American Medical Association, I emphasized the drying effect of some of the sulfonamide drugs. I do not think such an action is extreme, but it is something to be borne in mind—use of these drugs adds to the difficulty the children have in breathing.

To make a bad matter worse, some patients are given morphine or codeine before being sent to the hospital. Dr. Chevalier Jackson's timely warning against the use of these sedatives has either not been heard of or goes unheeded.

A tracheotomy may not be necessary for the mild form, but in cases of the severe type one often waits too long before the operation is performed. A tracheotomy of election is a conservative, life-saving operation and is not as radical a procedure as some general practitioners think. It should not be postponed until it becomes an emergency.

Forcing of fluids and steam inhalations make tenacious secretions less adherent and expedite bronchoscopic aspiration. Most of the patients are badly dehydrated. They need the help of the pediatrician. Teamwork is essential.

The laryngotracheobronchitis caused by a foreign body may present similar, but sometimes quite different, problems. I had an unusual case last winter, that of a Mexican baby, sent to the hospital for acute tracheobronchitis and laryngitis. The condition was due to a small corkscrew which had been embedded in the upper end of the esophagus for six months before I saw the patient. I believe any other child would have died long before the end of six months, but this Mexican child, probably three-fourths Indian, had survived the presence of the corkscrew. It was removed, and the child lived for a number of months. There was increasing obstruction of the esophagus, until a gastrostomy for feeding had to be done; about the time retrograde dilation of the esophagus was attempted the child died.

DR. C. L. JACKSON, Philadelphia: I should like to ask Dr. Gittins whether he has any cases in which the children inhaled zinc stearate. How serious is such an accident, and how should the condition be handled?

DR. T. E. WALSH, St. Louis: My associates and I have seen in the last month about 7 cases of the infectious type of laryngobronchitis, with 1 fatality, and we have felt that the good results were probably due to early tracheotomy. The child was not allowed to exhaust itself before something was done to help. We attribute our good results also to the immediate parenteral administration of large amounts of fluids and to the use of sulfadiazine. We have not found that the sulfonamide drugs have caused much drying. However, we did find that oxygen should not be administered routinely in these cases. I am sure that oxygen causes much more drying of the secretions. We have had to pull out thick, chewing gum-like plugs from the trachea and bronchi after use of oxygen. Lately we have eliminated the use of oxygen entirely and give carbon dioxide after tracheotomy, and the patient is placed in a heavily steam-laden room.

DR. THOMAS C. GALLOWAY, Evanston, Ill.: I was much interested in Dr. Gittins' classification of the traumatic forms. It is something to which not much attention is paid, and it is important.

It is my own feeling that in an allergic condition there is much more likely to be a thick secretion, spasm, narrow lumen and edematous mucosa.

I think one should heed Dr. Walsh's remarks about oxygen, as well as Davison's (*Ann. Otol., Rhin. & Laryng.* **49**:1083 [Dec.] 1940) fine demonstration of the value of mechanical humidification, which produces moisture-saturated atmosphere at a temperature of 70 F., and not at the temperature of 85 and 90 F. previously used in the steam room.

I hope Dr. Gittins will include under his methods of therapy postural drainage and irrigation, about which I have written and which I think is so important in the treatment of these patients. It adds much to the peace and ease with which the bronchoscopist can deal with the condition.

In my service in the Evanston Hospital, which includes both private and charity patients, there have been 9 consecutive recoveries, without a death. That, of course, does not include the cases in the county hospital, which I did not handle personally and in which the mortality rate has been much higher.

In my experience the use of postural irrigation and drainage has been the greatest source of comfort in treatment.

DR. BURT R. SHURLY, Detroit: What is the objection to intubation, instead of tracheotomy?

DR. T. ROY GITTINS, Sioux City, Iowa: The treatment of this condition has been discussed so much that one can hardly pick up a journal in which some one has not written about it; if I went into all the treatments for this condition I could spend a great deal of time. Practically nothing new has been recommended recently. No one, I think, is ready to say definitely what is going to be done with the sulfonamide drugs. There are so many other issues. If the patient has mechanical blocking, one does not have time to use any of these drugs, and many of the patients die even before one can do a tracheotomy.

In treatment, one has always to consider the type of case, the severity and especially the age of the patient, for the mortality varies inversely with the age. In children under 1 year of age the mortality is very high. Practically all children under 6 months of age die before they get to the hospital. With older children it is different. In the literature, the mortality varies from 11 to 75 per cent, and one man wrote me not long ago that his mortality rate was 100 per cent. I think it was courageous for a man to admit such a mortality. When one considers the wide range of mortality rates, it is clear that many different conditions must be under discussion.

The main point in the paper was the differential diagnosis. Every one has been discussing the subject as though all the cases were of one type. It is possible that many cases are included under the head of the infectious form which are instances of the milder types of the disease—traumatic, allergic and others.

If one gets too excited about the mild forms, many patients will be subjected to tracheotomy which is not necessary.

With respect to what Dr. Shurly said about intubation and tracheotomy, it has been pretty well accepted by all the men who have been working on this subject for years that tracheotomy is by far the safer procedure. If the patient is in a hospital with a competent resident on duty, and he is not any farther away than the end of the hall, then intubation may be all right, but inserting an intubation tube which may come out before one reaches the corridor may make for a greater emergency than if it had not been put in at all.

With children, the trouble usually constitutes an emergency, and the infection is descending. One may catch the disease in the trachea, in the larynx or in the bronchi, or it may end in the smaller divisions of the bronchial tree, with blockage regardless of the organism.

I am not too sure of the organism, and I do not think any one is. One can get cultures of Streptococcus or Staphylococcus from any nose. How does one know which is predominating and virulent?

Dr. Jackson, I do not know about the zinc stearate.

Manifestations of Dermatologic Diseases in the Upper Respiratory Tract. Dr. V. V. Wood, St. Louis.

This paper will appear in a future issue of the Archives.

Certain Aliphatic Compounds as Nasal Vasoconstrictors. Dr. Arthur W. Proetz, St. Louis.

This paper will appear in a future issue of the Archives.

DISCUSSION

Dr. J. J. Shea, Memphis, Tenn.: My associates and I have been making some of the clinical studies on the 2-amino-heptane sulfate. We have employed a 2 per cent solution. We have used it now on about 100 nasal mucous membranes, comparing it with the various office preparations which we have used in the past. Briefly, our clinical review shows that its effect outlasts any of the vasoconstrictors used in ordinary routine office practice. It is just as effective in cases of acute vasomotor disturbance as it is in those of acute inflammatory conditions.

Dr. Norton Canfield, New Haven, Conn.: Has Dr. Proetz noted any analgesic effect? If not, is there any incompatibility?

Dr. Thomas C. Galloway, Evanston, Ill.: Are there any secondary effects on the patients from the use of these materials?

Dr. James A. Babbitt, Philadelphia: I noticed that Dr. Proetz referred to the use of 2 per cent ephedrine. There seems to be a great deal of opinion expressed that 0.5 per cent ephedrine in saline solution is desirable. Do I understand from the paper that the use of a 2 per cent solution of ephedrine is desirable?

Dr. Burt R. Shurly, Detroit: Can this material be sterilized?

Dr. Arthur W. Proetz, St. Louis: The drug has no analgesic effect. Its incompatibilities are few, silver nitrate being probably the only one in this category. It is compatible with anything else which needs to be put in the nose. My associates and I investigated this point carefully before we used it.

The 2 per cent solution has a slight corrosive effect on the atomizer, but with the 0.5 per cent solution there is none. The solution can be sterilized by boiling and does not disintegrate.

There are certain persons in whom it does not work as well as in others; about every twentieth patient reacts very slowly to it. Its action is a little slower than that of ephedrine and other vasoconstrictor drugs, and this slow effect apparently is what prevents a systemic reaction. It remains in the tissues for a long time.

The drug will be on the market as soon as it has been thoroughly investigated by the clinical investigators who are working with it.

I mentioned in my paper that I had observed no secondary effects, and in the short time that I have been working with the drug I have found no patients who have become tolerant to it. It has been quite satisfactory.

With regard to the 2 or the 0.5 per cent solution of ephedrine, Dr. Babbitt, I routinely prescribe 2 per cent solution of ephedrine in isotonic solution of sodium chloride for my patients. It is much more effective than a 0.5 per cent solution. The specific difference I have found is a quick recovery from the 0.5 per cent solution and a long drawn-out recovery from the 2 per cent solution. This is especially true in allergic noses with a great deal of secretion. There, the 1 per cent is quickly diluted to 0.5 per cent. I have liked the 2 per cent solution, although in a few cases some systemic reaction was produced. If that occurs, I withdraw it and use neo-synephrin. If patients can tolerate a 2 per cent solution, it is much better, provided it is not put in in such a way as to remain over a long period. In the displacement treatment, for instance, I use a 0.25 or a 0.5 per cent solution, as suggested by Shambaugh, and find that it is adequate. It remains in the sinuses for eight or ten hours. A 2 per cent solution remaining in the sinuses for that length of time would be a considerable overdose for the patient.

Have I answered all the questions?

DR. V. V. WOOD, Philadelphia: Will this product be expensive?

DR. ARTHUR W. PROETZ, St. Louis: It is simple to make, and the price will not be out of line. It has been recognized since 1863, but nobody knew it was a pressor substance until recently. It was just a chemical curiosity on the shelf.

DR. HARRIS P. MOSHER, Marblehead, Mass.: How are the chemical changes brought about in the product?

DR. ARTHUR W. PROETZ, St. Louis: The amino group can be attached to the methyl radical to make a pentane.

DR. HARRIS P. MOSHER, Marblehead, Mass.: How do they produce the combination?

DR. ARTHUR W. PROETZ, St. Louis: It is a matter of temperature, pressure and that kind of thing—simple physical chemistry.

DR. T. E. WALSH, St. Louis: Does putting in an odor spoil the drug?

DR. ARTHUR W. PROETZ, St. Louis: The solutions we have used have little odor. One patient says they smell "like cats." All the compounds with this combination of carbon in the second position have this odor. The significance of this I do not understand.

DR. LELAND G. HUNNICUTT, Pasadena, Calif.: Does the patient acquire tolerance to it quickly, as he does to ephedrine?

DR. ARTHUR W. PROETZ, St. Louis: He does not, at least not in the six months that I have observed it.

DR. THOMAS C. GALLOWAY, Evanston, Ill.: I think you might give a historical summary of how the drug was developed. One ought to have certain ideas about the chemistry.

DR. ARTHUR W. PROETZ, St. Louis: I do not want to give the impression that I developed this drug. My report concerns only its clinical use.

The drug was discovered in the 1860's. I cannot recall the name of the discoverer at the moment. Last year Shonle and Rohrmann found out that this drug was a pressor substance. Then Chen and one of his two associates put it to pharmacologic and toxicity tests, and my own contribution is restricted to its clinical use and to laboratory tests on its effect on isolated epithelium.

DR. GEORGE M. COATES, Philadelphia: Is the material stable?

DR. ARTHUR W. PROETZ, St. Louis: Yes.

(To be Concluded)

Book Reviews

Ophthalmology and Otolaryngology. Volume II of Military Surgical Manuals. Prepared and Edited by the Subcommittee on Ophthalmology and Otolaryngology of the Committee on Surgery of the Division of Medical Sciences of the National Research Council. Price $4. Pp. 331, with 124 illustrations. Philadelphia and London: W. B. Saunders Company, 1942.

Many physicians entering the war from civil life are going to be almost immediately confronted by problems in fields other than those in which they have been accustomed to labor. Military exigencies make demands quite unlike conditions which obtain in times of peace. The great goal is, of course, to give to "our boys" the best possible medical and surgical skill, but the means of reaching that goal may be quite foreign to one's previous experience. All medical officers must be or become familiar with the principles of military surgery. Since time is so limited for extensive reading and study, it is necessary that these principles be "boiled down" to a high degree of practicability.

The texts in this series of "Military Surgical Manuals" have been written by outstanding authorities in special fields who are well known for their ability to simplify, insofar as possible, the intricacies of specialization.

The chapter on the eye considers functional testing and examination, acute visual disturbances and inflammations, injuries, local anesthesia and medical and surgical treatment. Naturally, no attempt is made to discuss muscle imbalance or the finer points in the use of the ophthalmoscope.

Under otolaryngology, chapter I takes up gunshot wounds of the face. Other chapters deal with fractures of the temporal and ethmoid bones; malingering; petrositis; the ear and aviation; injuries of the larynx, hyoid bone and trachea, and reeducation of the deafened soldier. Some of these matters are not, strictly speaking, "emergencies." For example, the front line surgeon cannot do much about petrositis, which is pretty much a problem for any otologist, even under the best hospital conditions. However, it has been much discussed in the literature of late, and may be included here for that reason, if for no other. Each and all of these manuals will be in great demand.

Ear, Nose and Throat Nursing. By James Hardie Neil, D.S.O., Croix de Guerre, F.R.A.C.S., F.A.C.S., Ear, Nose and Throat Surgeon, Auckland Hospital and Mater Misericordiae Hospital, Auckland, New Zealand; Past President Pan-Pacific Surgical Congress. Third edition. Price ?. Auckland: Clark and Matheson, Ltd., Printers, 1942.

The author presents a set of nursing notes on the ear, nose and throat, trachea and bronchial system. Much information is compressed in 126 pages, bound in paper covers.

Though the text is written especially for senior nurses, as stated in the foreword, the author feels that it may also be of value to resident medical officers because of the time-saving element and may serve as a guide to the general routine of the department. It is evident that he has happily succeeded in all these points.

The print is smaller than that of the average book, so that much material is found on each page. Preventive and nursing instruction is covered extensively; anatomic and physiologic data are presented at the appropriate places, and therapy is well detailed. Diagrams and illustrations serve to explain more fully the text matter.

The entire subject is presented in a sound and conservative manner, and the text is certain to be useful to senior nurses stationed not only in civilian hospitals but in the military regions. It will also be found of value to medical officers, as well as to all physicians who must obtain important data quickly and who cannot consult the larger works at the moment.